# Initial Public Offerings: A synthesis of the literature and directions for future research

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**Abstract:**

The purpose of this chapter is to provide an overview of the IPO literature since 2000. The fewer numbers of companies going public in recent years has raised many questions regarding the IPO process, in both academic and regulatory circles. As we all strive to understand these changes in the market, it is especially important to understand the dynamics underlying the IPO process. If the process of going public is too costly or the IPO mechanism is plagued by too many conflicts of interest among the various intermediaries, then private companies may rationally choose other methods of raising capital. In a related vein, it is imperative that new regulations not be based on research focusing solely on large, more mature firms. Newly public firms have unique characteristics, and an increased understanding of such issues will contribute positively to well-functioning public markets and further growth of the entrepreneurial sector.

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## Introduction

Transitioning from private to public status is a watershed event in the life of any firm. For most firms and managers, the process of conducting an IPO is something they will only go through once. As such, there exists much uncertainty over the process, starting with the decision of whether to go public and including issues such as when to go public, who to select as advisors, how to price the offering and how to structure the governance of the newly public firm. A broad set of academic literature has studied all of these issues, and the purpose of this chapter is to review the existing evidence and also to suggest areas in which our understanding is less complete and which would benefit from further research.

We begin with a discussion of why firms go public. While the most obvious factor would seem to be the raising of capital, this is far from the only determinant and many studies conclude that it is not the most important determinant. A continuing debate in the literature concerns whether firms go public primarily to raise money for future investment or for other reasons such as market timing, i.e., because they expect the market to value them higher than their 'true' value. We review the evidence on both sides of this debate and also discuss the myriad of other factors that potentially play at least some role in managers' decisions to take their firms public: capital structure re-adjustment, providing liquidity for the owners, advantages of having a publicly observable stock price, compensation, and the credibility that comes with having multiple parties scrutinize the firm (e.g., analysts, institutional investors, etc.).

Given the broad array of factors that motivate companies to go public, it is perhaps not surprising that the types of firms going public varies widely. In the interests of providing the reader with an informed overview of this market, we highlight a number of important stylized facts concerning the IPO market in Section 2. One of the many fascinating things about this

market concerns the ways it has varied over time, and for this reason we disaggregate many of these stylized facts by time. Capital markets in the U.S. change and evolve at a relatively rapid pace, and consistent with this we observe strong differences in the types of companies choosing to go public and also in the ways in which they structure their offerings. It will perhaps be informative to consider jointly some of these time trends as a way to better understand the changes in our markets, including for example the lower frequency of IPOs over the past 15 years.

More than most corporate events, IPOs present a number of "puzzles". For example, it is well known that IPOs are on average underpriced, with average first day returns of approximately 15% - but the reasons for such large one-day returns continue to be debated. Beyond this one-day return, the returns associated with IPOs over longer time intervals are more complex. Do IPOs underperform over the long-term, measured as the three or five years following the offering? The answer is yes if we compare them to a broad market index, but the answer is no if we compare them to firms of similar size and book-to-market.

The story becomes even more complex when we consider the strong time-series fluctuations within each of these pricing patterns. We know that many companies go public during some periods but relatively few in others. Over many decades, this variation was explained largely by fluctuations in companies' demands for capital and by changing investor sentiment that influenced the price at which a company could sell itself. However, neither of these factors is sufficient to explain the dramatic fall in the number of IPOs since 2000. Finally, the type of company going public in "hot" versus "cold" markets is different and there is some evidence that companies going public during hot markets perform worse, but measurement issues can make definitive conclusions difficult.

These fluctuations in performance highlight the extent of uncertainty surrounding these companies. In fact, 36% of IPO firms delist within the first five years after the IPO, with 12% being due to poor performance and 24% because they are acquired. In addition, many companies that start the process to go public do not complete the process: 20% of IPOs are withdrawn, and of those that are withdrawn relatively few ever successfully complete an IPO.

Given this high uncertainty combined with the fact that most companies only ever conduct an IPO one time, intermediaries have the potential to play a particularly important role. The number of intermediaries involved in the months surrounding many firms' IPOs is large: venture capitalists, underwriter banks, lawyers, analysts, institutional investors, regulators, etc. While the effects of some of these intermediaries has received considerable attention, the influence of other parties, e.g., regulators, is less understood. We both overview the current state of knowledge regarding the roles of these various entities, and comment on what we perceive to be gaps in our understanding.

Finally, an area of growing research concerns the governance of newly public firms. While multiple forces in the markets (e.g., exchange listing requirements, pension fund recommendations, proxy advisory service company recommendations) have been pushing firms toward a common set of governance standards, there are reasons to believe that the governance demands of newly public firms are unique and very different from those of their more mature counterparts. Because the vast majority of corporate governance research is based on similar samples of mostly mature firms such as the S&P1500, the aforementioned recommendations are largely based on these mature firms. We argue that these conclusions are frequently not appropriate for younger firms. We review the still nascent literature in this area, and encourage further research along this dimension.

Perhaps the issue that has garnered the most attention in recent years with respect to IPOs is the decreased number of them. Why are fewer companies choosing to raise public equity on US markets? While new companies are being founded on a regular basis, these small private companies are with increasing frequency being acquired by large, already public companies. As a result, a smaller number of companies are controlling an increasing percentage of entrepreneurial activity. From an antitrust perspective, this raises obvious concerns. A lack of sufficient competition has the potential to put a downward bias on future innovative activity. We hope that a more complete understanding of many dynamics surrounding IPOs, as overviewed in this chapter, will help guide researchers in efforts to better address these issues. To the extent that companies are increasingly concluding that the costs issuing public equity for the first time exceed the benefits, it is clear that we need a better understanding of these costs and benefits and the ways they have changed over time.

The literature on going public is rich and vast. Given the depth and breadth of the literature we made a decision to concentrate this review mainly on research published in the 21st century. And even within this prism we were not able to both cover all grounds and keep this review within a manageable length, while delving into some of the topics more deeply. To facilitate discussion and analysis of the most important facets of the IPO process, we also decided to replicate some of the main empirical results concerning IPOs ourselves using the most comprehensive coverage in terms of the length of the sample period and the cross section of firms included. This enables us to see how some of the empirical regularities have changed over time and how others are more immune to the time period one examines.

The rest of this review is structured as follows. We start in Section 1 by reviewing the reasons that firms go public. Having established firms' basic motivations for public listing,

Section 2 provides an empirical overview of the key aspects of the IPO process, over the past 44 years, 1972 – 2015. Section 3 provides a detailed discussion of the institutional details surrounding the IPO process, which are key to understanding this market. Section 4 reviews the rich literature, both theoretical and empirical, on the pricing of IPOs, and Section 5 discusses the role of intermediaries throughout the IPO process. Sections 6 and 7 review the literature and evidence on post-IPO returns and cycles in the IPO market, respectively. Finally, Section 8 discusses the burgeoning literature on governance of newly public firms, and Section 9 concludes.

## 1. Why do firms go Public?

Why do firms go public? On the face of it, the answer sounds obvious: firms go public to raise capital because they need money for investments. Let's assume for a moment that this is indeed an important reason why firms go public. Still it cannot be the complete answer: A question still remains. Why do firms choose to raise capital in the public equity market and not in the private equity market or in the debt market? In other words, why do some firms go public while others refrain from doing so and raise capital through other means? In this section we attempt to give some perspective about these very important questions. We feel that the issues we discuss here are not only important, but that our current knowledge is insufficient. These questions provide fertile ground for future research.

### *1.1 Firms' motives for going public*

Our starting point is the relation between a firm's investment needs and the decision to go public. The striking result Pagano Panetta, Zingales (1998) document is that the answer to this question is not obvious. They examine the determinants of going public in the Italian market and find that future investment needs is not the dominant reason why firms go public, at least not in the sample of the 66 IPO firms they examined. They find that the main factor affecting the probability of going public is the industry market to book ratio. This result suggests that perhaps firms in industries with higher investment opportunities-- and hence higher investment needs -- are more likely to tap the public equity market. However, it may also suggest that firms in industries that are over-valued are those who decide to go to the public equity markets. Possibly, firms go public because they can. Not because they need. Examining those firms' performance in

the years after the IPO, Pagano et. al. (1998) find that both their investment and profitability decline, suggesting over-valuation as the more likely explanation.[1]

Pagano et al (1998) also find that larger firms and firms that have experienced higher growth are more likely to IPO. These latter findings may be unique to Italy or to the time period of the study. In a very interesting paper Brau and Fawcett (2006) use a survey method and ask 336 CFOs why firms go public. Strikingly, there is no evidence that a need for cash is the driving force behind the IPO decision. This result, that a need for cash does not show up as a dominant motive for going public, is interesting and surprising. It is not what we would expect. Using a large set of firms from across the globe Kim and Weisbach (2008) took another look at a related question: They analyze how firms spend the money they raise through equity issuances. (So unlike the Pagano et al paper, they do not examine why firms go public rather than staying private. The question they ask is what IPO and SEO firms do with the money they raise.) Not surprisingly, they find that in the year of the IPO cash reserves increase by about 50 cents on every dollar raised. Four years after the IPO the cash reserves are still significant higher (about 40 cents on the dollar). The second largest impact is on investment (capital expenditure and R&D). There they find an increase of about 28 cents on each dollar raised in the first year and a much larger increase after four years. These are important findings, suggesting that a significant portion of the money raised through the IPO is being used for investments. Of course, money has no color, so we do not know whether the IPO money went to finance investments, or came from other sources such as earnings over the years following the IPO. Likewise, some of this money may have been channeled back to investors through share repurchase programs or dividends.

[1] Pastor, Taylor and Veronesi (2009) develop a model in which post-IPO declines in profitability occur in spite of no overvaluation or behavioral effects. Such declines are the result of owners rationally choosing to go public when the diversification benefits are sufficiently high to outweigh the loss of private benefits of control.

Kim and Welsbach control for the first issue (other sources of funds) but not for the second. Nevertheless, the Kim and Welsbach study presents important evidence suggesting that a significant portion, though not the majority, of the money raised through the IPO financed firms' investments.

At the same time it is important to note that the study, by design, does not attempt to address the question of whether the IPO firms could have achieved their goals through other means of equity capital raising, be it through VCs or other private equity vehicles that are becoming more and more popular; or through private debt.

At this point it is worth summarizing the possible objectives for firms to go public and whether those objectives can be achieved through other vehicles such as private equity or debt. We can think of many possible reasons, which are not mutually exclusive. The first, is the need for cash for investment. As also summarized in Table A, this need can be achieved through private equity or debt. Thus if investment is the main motive for going public we would like , ideally, to be able to show that firms use the proceeds for investments and to understand why they chose this channel (IPO) rather than other channels.

The second reason is over-valuation. If over-valuation is common for both public and private equity (as we expect), it can be a good reason for why firms raise equity capital; but not why they go public. For the latter, there must be another friction. For example, over-valuation is more pronounced in public than in private markets. Lowry's (2003) finding that more companies go public when investor sentiment is higher suggests that overvaluation is a significant determinant of the decision to go public. In economic terms, her findings suggest that it is more important than demand for capital (e.g., for future investments).

The third reason is capital structure adjustment. This clearly can be achieved both with public and private equity markets.

The fourth reason is owners' need for liquidity. Shortly after a firm goes public its owners, both individuals and VCs can liquidate (part or all of) their positions with minimal transaction costs. The liquidity provision allows holders to buy and sell their stocks any time after the end of the lockup period. This goal can be achieved only through the public equity channel. Selling securities of private firms can be prohibitively costly. This liquidity reason may be even more acute when VCs have stakes in the company, as they must liquidate their investments within a set number of years. (This of course can be done either through an IPO or through an acquisition by another company.) Using data on industrial firms from the census, Chemmanur, He and Nandy (2009) find that firms in industries with great average liquidity of already listed equities are more likely to go public. Like Pagano et al, they also find that larger and more successful firms are more likely to go public.

Owners' diversification (reason #5 below) represents another potential reason to go public. IPOs allow the original owners to diversify their holdings and increase liquidity by selling shares in the secondary market. (To the extent that an occasional secondary equity offering is possible also in the private equity markets, owners' diversification, at least to an extent, can be achieved both in the public and private markets). A natural extension of the basic diversification story is that less diversified shareholders have more to gain from taking their firm public, and hence may be willing to accept a lower IPO price. Bodnaruk, Kandel, Massa, and Simonov (2008) study the effect of controlling owners' diversification on the IPO price, specifically whether they are more willing to accept a lower price for shares. Using Swedish data with detailed information about owners' portfolio composition between 1995-2001, the paper

finds that: (1) private firms held by less diversified controlling shareholders are more likely to go public; (2) less diversified individual shareholders sell more of their shares at the IPO; (3) the extent of owners' diversification is related to the underpricing of the IPO. While the data used in this study is limited, its findings are interesting and insightful, suggesting that diversification is an important factor in the decision to go public. Chod and Lyandres (2011) examine a different aspect of diversification, arguing that public firms' owners tolerate higher profit variability than owners of private firms because of their ability to diversify. Hence, public firms can take riskier investment strategies than private firms -- which improves their competitive position. This adds another aspect why diversification through IPO may be beneficial.

The sixth reason in the table below encompasses several motives, as related to the presence of a publicly available market value of the firm's equity. It is argued that often firms go public because they want to use their publicly traded stocks as acquisition currency (versus having to pay for acquisitions with cash). This is a valid motive to go public, in the presence of some market friction such as financial constraint that may prevent companies to raise additional equity if they need cash for acquisition. Alternatively, if insiders believe the firm is overvalued then paying with equity rather than cash may be preferred. This motive is unique to IPOs and cannot be achieved if the company remains private, even if it issues shares in the private market. Brau and Fawcett (2006) using surveys, find that the primary motivation for going public is to facilitate acquisitions (#6 in the Table above). They also find support for the notion that market timing plays a role in the decision. Relatedly, Hsieh, Lyandres, and Zhdanov (2011) suggest that the reduction of valuation uncertainly associated with having a market value through the IPO process leads firms to a more efficient acquisition strategy—and hence also increases its value. Some theoretical research argues that the going public decision strengthens the insiders'

bargaining position in the case of an acquisition (Zingales 1995), and allows insiders to cash out at a higher valuation-- and hence increases the firm value.

Another reason (# 7 in the table below) that is closely tied to having a publicly available market value relates to compensation, specifically the ability for firms to use the price of their publicly traded shares to value stock options given to owners and employees. Going public allows firm's stakeholders to have an agreed upon firm-value which can be used for various purposes. Relatedly, the 8th reason is based on the idea that since market prices aggregate the valuation of many market investors (e.g., Grossman and Stiglitz, 1980) they can also be used as a source of information to the firm about its value or even the course of action it is taking.

Being a public firm offers an additional benefit to firms, in the form of certification and reduction of uncertainty (#9). The scrutiny of the SEC (e.g., Lowry, Michaely, and Volkova, 2016) combined with the constant watching and nudging of sell-side analysts, activists, and other investors adds credibility to the firm, certifies its value. The reduced risk and greater transparency achieved through the going public process also increases the confidence of suppliers and consumer about its value and well-being; which in turn affect its cost of dealing with suppliers, its cost of debt capital and revenues. This value certification reduces the uncertainty and potentially results in high valuation. However, the flip side is that for the right or wrong reasons, many managers do not like the scrutiny by market participants. In either case, it is difficult to see how this can be achieved in the private equity market.

Finally, reason # 10 suggests that going public may be an effective marketing device: it puts the firm in center stage both in the financial community and perhaps more importantly, among consumers. Thus going public can increase its consumer base, increase consumer loyalty—especially since consumers can now become shareholders. This can both increase

revenue and decrease the cost of capital. The broadening of investors' base can also increase stock liquidity. Neither private equity nor debt instruments will achieve these goals.

These motives and how they relate to the decision of whether to raise capital (public equity, private equity, or debt) and how they relate to the decision to go public (vs. private equity or debt) are summarized in Table A. Nine out of the ten reasons we outlined are not related to the fact that firms exchange stocks for cash during the IPO process. That is, they do not suggest that firms go through an IPO because they need cash. The relative importance of these motives remains an open empirical question.

**Table A: Summary of reasons companies go public**

| | **Source Of Capital** | **Public Equity** | **Private Equity** | **Debt** |
|---|---|---|---|---|
| 1 | Investment | + | + | + |
| 2 | Overvaluation (market timing) | + | + | 0 |
| 3 | Capital Structure Adjustment | + | + | - |
| 4 | Stock liquidity | + | 0 | 0 |
| 5 | Owners' Diversification | + | + | 0 |
| 6 | Currency for Acquisitions | + | 0 | 0 |
| 7 | Compensation and Market Valuation | + | 0 | 0 |
| 8 | Feedback effects from market | + | 0 | 0 |
| 9 | Certification by analysts, SEC and markets | + | 0 | 0 |
| 10 | Marketing | + | 0 | |
| 11 | Corporate control | + | 0 | |

So why do firms go public? We believe we know the possible motives (as we outlined in the Table above), but we need more direct evidence on the relative importance of the various motives. Interesting evidence from Sweden suggests that diversification is an important motive. The evidence we discussed on the need for cash as a reason for IPO is mixed, but it is very likely to play some role. There is more consistent evidence that having a verifiable market value is an important motive, be it for acquisition currency, stock options, or ability to take more aggressive strategies. Why firms go (or do not go) public is perhaps one of the most important questions related to IPOs, with significant possible implication on policies, governance, and on firms' cost of capital. It would be wonderful to have more, and more complete evidence on this issue.

### *1.2 Changes in benefits vs costs of going public, in recent years*

Many of the models described above incorporate the costs as well as the benefits of going public vs. staying private, as well as how these costs and benefits may change over time. The Maug (2001) model, for example, suggests that an IPO occurs when insiders' information advantage over outsiders disappears; a natural progression over the firm's life cycle. More generally, the going public decision is an equilibrium outcome such that at the time of going public, the benefits outweighs the costs. It is therefore important to study the timing of going public as well as the type of firm that decides to go this route.

The reduction in the number of public firms in the last 25 years (Grullon, Larkin and Michaely, 2016) and the reduction in the number of firms going public (Gao, Ritter, and Zhu 2013) suggest that the costs of being public may have increased and/or the benefits of being public decreased over the last several decades. Several papers have attempted to shed light on this issue.

Regarding the costs of being a publicly listed firm, reporting requirements have become more complicated and time consuming, and there is increased pressure on management to pursue short term, rather than long-term objectives. Interestingly, neither Gao, Ritter, and Zhu (2013) nor Doidge, Karolyi and Stulz (2013) find support for increased regulation playing an important role: they find no evidence that either the Sarbanes-Oxley Act of 2002 or the 2003 Global Settlement had a material effect on IPO activity. However, Ritter (2011) conjectures that such regulatory changes have probably had at least some effect.

Doidge et al (2013) conjecture that financial globalization has contributed toward the lower numbers of companies going public in the U.S., i.e., that the net benefits of going public in the US versus in other markets have decreased. Consistent with this, the fraction of worldwide IPOs occurring on US markets has fallen from 50% or more in the early 1990s, to approximately 30% in the late 1990s, to 10% or less in the 2007 – 2011 period. At the same time, financial globalization has increased. While these trends appear consistent with increased globalization contributing to the fall in US IPO volume, a more critical examination casts doubt on this conclusion. Specifically, while the fall in US IPOs is significantly related to the increased globalization, Doidge et al's findings are not consistent with IPOs in the rest of the world simultaneously increasing. In other words, they find no evidence that companies are choosing to go public in other markets rather than in the US.[2]

Gao et al (2013) highlight that the decrease in the number of companies going public is concentrated among small offerings, and they offer an economies of scope argument for the observed trends. They conjecture that it is increasingly difficult for small firms to operate independently in today's rapidly changing markets. Thus, small firms find it increasingly

[2] Specifically, Column 2 of Table 8 of Doidge et al indicates a small negative effect of globalization on Non-US IPOs, -0.297 (= $\beta_{Globalization} + \beta_{NonUS*Globalization}$ = -1.656 + 1.359).

optimal to sell out to larger firms, who have a broader network to develop products more quickly and to bring the products to market faster. Consistent with this, both Brau, Francis and Kohers (2003) and Gao et al document that venture-backed firms are increasingly likely to be acquired: the percentage of VC-backed firms exiting via acquisition as opposed to IPO has increased from the 25-35% range over the 1991 – 1996 period, to the 40 – 60% range over 1997 – 2000, to over 80% since 2001. Moreover, these trends are particularly strong among small venture-backed private firms. Along the same lines, Grullon et. al (2017) report that the average US firm tripled in size (in real terms) since the turn of the century, consistent with the notion of economies of scope. We note that these patterns are informative, and we would like to encourage future research that could examine the causal effects of such influences.

Finally, while historically a key benefit of being a public firm was broader access to capital from a disperse group of shareholders, in recent years such capital has become increasingly available to private firms. In other words, some researchers suggested that the spread between the opportunity cost of capital for private and public firms had narrowed in the last decade. In a study of 13 mutual fund families (103 unique funds) across the 1995 – 2015 period, Kwon, Lowry, and Qian (2017) document that these funds in aggregate held less than $20 million in VC-backed private firms in 1995 and 1996, $70 – 120 million between 2000 and 2010, and $7 billion in 2015. They find some evidence that this increased availability of funding enables companies to stay private for longer. Importantly, mutual funds represent just one of several sources of funding available to private firms, with other sources including pension funds and sovereign wealth funds. The extent to which changes in the market continue to make such capital increasingly available has the potential to substantially influence the IPO market in the future.

## 2. Stylized Facts

In this section, we review the stylized facts about IPOs using a long-term data sample of initial public offerings in U.S. While some aspects of IPOs remain relatively constant throughout the 43 years of our sample period, other relations vary with the time and with market conditions. IPO data for this section is pulled from the SDC Platinum database and consists of the companies that went public on the NYSE, AMEX and Nasdaq stock exchanges between 1972 and 2015. Consistent with the vast majority of academic research, the constructed sample excludes REITs, units, ADRs, closed-end funds, offerings with the stock price below $5, and companies not listed on CRSP within 14 days of the IPO. The start of the sample corresponds to the beginning of SDC Platinum IPO coverage. The total sample includes information on approximately 9,145 initial public offerings that satisfy these criteria. Additional data is collected from CSRP and Compustat.

We decided to replicate many of the results concerning IPOs for three reasons. First, it allows us to verify many of the results reported in prior literature and to examine their empirical validity over longer time periods. Second, while many studies use different sample selection criteria and different methodologies, here we use a unified and consistent empirical framework allowing for better comparison among the different results in the literature. Third, results presented in this section are based on a sample of IPO that is larger than that of any published paper of which we are aware.[3]

Figure 1 and Table 1 show how both the number of IPOs and total proceeds raised in IPOs vary over time. Throughout the 1970s, the number of companies going public each year

[3]For example, our sample includes a greater number of IPOs than Ritter (https://site.warrington.ufl.edu/ritter/files/2016/12/IPOs2016Statistics_Dec21_2016.pdf) because we do not exclude banks.

was quite low, with an average of 16 IPOs per year. During the mid-1980s IPO volume was markedly higher, with 341 IPOs per year over the 1983 – 1987 period. After another dip in the late 1980s and early 1990s, IPO volume rose to record levels in the mid to late 1990s. The year 1996 witnessed the highest number of IPOs, with 709 offerings in that single year—an average of almost three IPOs per trading day. There continued to be many IPOs over the rest of the 1990s, and then very few following the crash of the internet bubble in 2000. Many of these fluctuations in IPO volume are strongly positively correlated with market-wide returns. However, since 2000 IPO volume has never recovered to anywhere close to the levels observed in the 1990s, despite strong market performance during much of this period. As shown in Figure 4 (and also discussed by Gao et al (2013)), the majority of this drop in IPO volume has been among smaller companies. Larger companies have continued to go public at a similar pace. Smaller private companies have become increasingly likely to be acquired rather than to go public.

Total annual IPO proceeds (all expressed in constant 2015 USD) follow a trend similar to that shown for the number of firms going public, throughout much of this period.[4] Aggregate proceeds raised averaged $530 million per year in the 1970s, compared to $11 billion per year in the 1980s, and $39 billion per year in the 1990s. Following the crash of the internet bubble in 2000, aggregate proceeds have recovered to a greater extent than the raw number of offerings. While the average number of companies going public since 2000 (135 per year) is about a third of the number of IPOs in the 1990s (457 per year), proceeds raised during the two periods are more similar (an annual average of $39 billion during the 1990s compared to an annual average of $32 billion between 2000 – 2015). This is driven by the fact that the average size of

[4] We deflate using the GDP Implicit Price Deflator rather than the CPI because the GDP Deflator reflects changes in prices in the entire economy, rather than changes in prices of a fixed basket of consumer goods.

companies going public has increased substantially over the past 15 years. Over the entire sample period, the annual correlation between number of IPOs and total annual proceeds is 0.71, and it is an even higher 0.89 over the early sample period 1972 - 2000.

Figure 2 shows average initial returns across all companies going public each year, with the number of IPOs plotted on the same graph to facilitate comparisons of the two. Initial returns are defined as the percent difference between the offer price and the closing price on the first day of trading. Across our entire sample of 9,145 IPOs average initial returns equal 19.1%, but the figure highlights the extent to which this average has varied over time. Average initial returns each year ranged between 2 – 15% in the 1970s, 2 – 16% in the 1980s, 8 – 77% in the 1990s, and 5 – 20% since 2001. During the height of the Internet Bubble period, average initial returns reached record levels: 77% in 1999 and 59% in 2000. In addition to varying substantially over time, there is also a co-movement between IPO volume and initial returns. Using lower frequency monthly data, Lowry and Schwert (2002) show that initial returns tends to lead IPO volume by approximately three months, meaning that high initial return periods tend to be followed by many companies going public. While this lead-lag feature of the data is difficult to discern at the annual frequency shown in Figure 2, the positive correlation between the two series is evident.

Figure 3 is similar to Figure 2, but it plots average annual initial returns against aggregate proceeds raised in IPOs each year. The strong positive relation between the series is even more evident here. Both metrics spike in 1999: aggregate IPO proceeds reach $83.7 billion and initial returns average 77%.

Figure 4 provides some more details on the relation between initial returns and proceeds. Specifically, we divide the sample into three bins: IPOs with proceeds less than $30 million,

IPOs with proceeds between $30 and $120 million, and IPOs with proceeds greater than $120 million (all measured in constant 2015 USD). This disaggregation highlights several patterns. First, the number of the small IPOs has decreased markedly over time, and there are very few IPOs with proceeds less than $30 million since 2001. Between 2001 and 2015, there were a total of 145 IPOs in this category, which represents less than 9% of all IPOs over this period. Second, the number of the largest IPOs, i.e., those with proceeds greater than $120 million, as a portion of all companies going public has risen dramatically. Third, in the earlier part of the sample the smallest IPOs tended to be more underpriced, but since the 1990s this relation has reversed and it is the largest IPOs that are frequently the most underpriced.

Figure 5 depicts how the level of underpricing varies depending on where the offer price was relative to the initial price range, as stated in the prospectus. Companies that are priced below the initial range have average underpricing of 2.4% and this level is relatively stable over the all sample years. In comparison, companies that are priced within the initial price range have average underpricing of 15.0%, while companies priced above the range have an average underpricing of 56.8%. Initial returns for these two latter groups is even higher during the Internet Bubble period.

Figure 6 shows show the level of initial returns varies across offerings that are VC- versus nonVC-backed, and it also shows patterns in VC backing over time, where firms are denoted as VC-backed according to the Venture Capital Backed IPO Issue Flag in the SDC Platinum database. Across our entire sample period 37% of our IPOs are VC backed. This proportion has risen somewhat over our sample period, from 33% in the 1970s and 24% in the 1980s, to 37% in the 1990s and 49% over the 2000 – 2015 period. VC-backed issues tend to be more underpriced than their non-VC backed counterparts, with average initial returns of 32%

versus 11%. This difference is particularly pronounced during the Internet Bubble, with average initial returns of 100% versus 42% among VC-backed versus non-VC backed IPOs, respectively, in 1999. At least part of this difference likely stems from differences in underlying company type. VC-backed companies tend to be younger (9 versus 24 years old, on average, for VC vs non-VC backed IPOs, respectively) and are more likely to belong to a technology industry (79% of VC-backed IPOs are in technology, compared to 28% of non-VC backed IPOs). As discussed in detail in Section 4, young age and membership in a technology industry are associated with higher information asymmetry, which tends to result in higher underpricing (as shown theoretically by Rock (1986) and Beatty and Ritter (1986), and empirically by Michaely and Shaw (1994)). Data underlying these trends are shown in Table 4.

Figures 7 – 9 examine various aspects of the underwriting syndicate, with Figures 7 and 8 focusing on the percent of proceeds that goes toward underwriter compensation and Figure 9 looking at the members of the syndicate beyond the lead underwriter(s). Direct underwriter compensation for managing an IPO represents a fixed portion of IPO proceeds and is called the underwriter spread. As shown in Figure 7 and Table 5, the underwriter spread most commonly equals 7%. In our sample, more than a half of all IPOs have an underwriter spread of this magnitude. On average, the underwriter spread has decreased over time. For instance, more than three quarters of all IPOs in the first years of our sample had a spread above 7%, compared to less than 5% of all IPOs in the last decade of the sample. At the same time, the portion of companies with a spread equal to 7% grew throughout the 1980s and 1990s, and the portion of companies with a spread less than 7% has increased over the past 15 years.

Underwriters tend to charge larger IPOs a smaller spread. For instance, the average spreads are 7.7%, 6.9%, and 6.2%, for IPOs with proceeds below $30 million, $30 – $120

million, and above $120 million, respectively. Thus, the decrease in the average underwriter spread over the past 15 years partially reflects the higher prevalence of large deals over this period. Figure 8 depicts the time-series dynamics of underwriter spreads by IPO size. One of the most pronounced observations from this figure is that the average spread for the medium size IPO remains unchanged over the entire period, at 7.0%. Average spreads for the large IPOs are more volatile, but there is no apparent time trend. Finally, spreads for smaller IPOs have tended to decrease over time. Thus, the decrease in spread shown in Figure 7 is likely due to the changing nature of the type of firms that go public rather than a fundamental change in the equilibrium level of the spread.

Figure 9 and Table 6 show the composition of the IPO investment bank syndicate, which consists of lead managers, co-managers and other syndicate members. Panel A shows statistics related to the lead manager and co-managers over the entire 1972 – 2015 sample period, whereas Panel B focuses on the shorter 1997 – 2015 period for which available data allow us to look at the total syndicate composition. The panels show an interesting contrast. The average number of lead and co-managers has increased up through 2009 and then remained relatively constant, whereas total syndicate size has decreased over the 1997 – 2015 period. Looking first at panel A, in the 1970s, the average IPO had only one lead underwriter and only one out of three IPOs had a co-manager. Over our 43-year sample period, the number of lead underwriters has increased from 1 to 3.3, on average. At the same time, the number of co-managers has increased markedly as well. Panel B shows that contemporaneous with this increase in participation of lead and co-managers, participation of other syndicate members has fallen dramatically. SDC data, on which these figures are based, indicate that the average IPO had 15 syndicate members in 1997 compared to zero in 2015. This is surprising. It suggests that all the IPOs in 2015 had no

syndicate members other than lead underwriters and co-managers. We therefore verified manually all of the prospectuses of the 2015 IPOs; in addition, a random sample of IPOs in other years revealed no systematic errors in these SDC data.

Figure 10 and Table 7 illustrate the average registration length, for companies going public between 1983 (the first year necessary data are available on SDC) and 2015. The registration period is defined as the number of days between the filing date and the offer date. During the 1980s the average length of the registration period was 44 days. It has increased steadily over most of the sample period, then spiked upwards during the financial crisis years of 2008 and 2009 and fell following the passage of the JOBS Act in 2012. While the exact causes of the spike around the Financial Crisis are beyond the scope of this review chapter, we posit that the substantially greater demands on regulatory agencies, highly uncertain market conditions, and offering postponements by the IPO companies were all contributing factors. The JOBS Act has a more mechanical effect on registration periods. Companies filing under the JOBS Act are allowed to 'test the waters' by distributing a version of the prospectus with qualified investors before the roadshow and before any version of the prospectus is publicly filed on EDGAR. Thus, the filing date, as measured by the first prospectus filing on EDGAR and recorded as such in SDC, occurs later in the process for companies filing under the JOBS ACT. This results in a shorter registration period for these companies.

One of the key determinants of the registration period involves interactions with the SEC regarding approval of the prospectus. The SEC reviews the prospectus of each company going public, and issues comment letters detailing issues that need to be clarified, elaborated upon, etc. In response to each comment letter the company must issue a revised prospectus, and the company is not permitted to go public until it has satisfied all SEC concerns. As shown in

Figure 11, the extent of SEC review, as measured by the number of comment letters, varies considerably across companies, from a minimum of one letter to more than eight letters. There is a nearly monotonic relation between the number of SEC letters and the length of the registration period. On average, each additional round of SEC review is associated with 28 extra days in registration.

In addition to the SEC review process influencing the length of the registration period and thus the timing of the IPO, there are other factors that also affect the timing of a companies' offerings. These other factors primarily relate to an effort to time both their roadshows and offerings for period when market attention will be sufficiently high. Because companies go on roadshows several weeks prior to the IPO, this means that IPO volume tends to be lower both immediately following vacation times. As shown in Panel A of Figure 12, companies are less likely to go public in January (following the December holiday season) and in September (following the August vacation season). Somewhat surprisingly, volume is not markedly lower in the months of August or December.

The general objective of going public when market attention is sufficiently high also yields within-week patterns. Only 136 out of 9,145 IPOs started trading on Mondays. Trading volume and daily returns tend to be lower on Mondays (Lo and Wang, 2009), and consistent with this Panel B of Figure 12 shows fewer IPOs on these days. In addition, the fact that the offer price is generally set the night prior to the offering further decreases the number of Monday IPOs. Finally, there are also a greater number of holidays on Mondays when the market is closed, which also contributes to these patterns.

While many of the above figures highlight substantial time-series variation in many aspects of IPOs, a striking contrast is the relative constant level of offer prices throughout our

43-year sample period. Despite average inflation per year of 3.6% over the sample period, Figure 13 shows that there has been no upward trend in the offer price. This relatively constant offer price holds across offer size categorizations, but is higher among larger IPOs. Average offer prices equal $9.90, $13.60, and $19.30 among IPOs with proceeds less than $30 million, $30 - $120 million, and greater than $120 million, respectively. It is possible that higher offer prices represent a signal about company characteristics, though we are unaware of any model that formalizes such a scenario. While we find the lack of an upward trend in prices over time to be puzzling, we note that it is consistent with relatively constant average prices among publicly traded stocks. Specifically, Benartzi, Michaely, Thaler, and Weld (2009) find that the nominal stock price has been $30 over a long time period.

Finally, Figure 14 and Table 9 provide evidence on the outcome of these IPO companies, three, five and ten years after the IPO. Panel A shows the percent that are delisted for poor performance, and Panel B shows the percent that are acquired. For comparison purposes, each panel also shows the number of companies going public each year. Looking first at Panel A, it is striking that a greater percent of companies going public during 'hot markets' tend to delist for poor performance over subsequent periods. There is some evidence that this effect is greatest for companies going public during the latter part of these hot markets. For example, over the 1990s boom period, the greatest number of companies went public during 1996, and the rate of delisting was greatest for those that went public during 1998 and 1999. Almost 30% of companies that went public in 1998 were delisted for poor performance within the subsequent ten years.

Panel B of Figure 14 shows a similar albeit weaker pattern in the percent of IPOs that are acquired. There is some evidence that companies going public in hotter markets are more likely

to be subsequently acquired. For example, 40% of companies that went public during 1998 were subsequently acquired (in addition to the 30% that delisted for poor performance). Together, Panels A and B highlight that a relatively small portion of companies that go public are still independent and publicly traded ten years later.

One of the more hotly debated issues with respect to IPOs regards their long-run abnormal performance. Tables 10 and 11 present an overview of post-IPO performance, using different benchmarks, different methodologies, and over different sample periods. Given the complexities of this issue (e.g., the appropriate benchmark, the appropriate methodology, etc.), we devote an entire section to this topic. We defer a discussion of the results in Tables 10 and 11 until Section 6.

## 3. The IPO process[5]

A milestone for any company is the issuance of publicly traded stock. While companies may have many motivations for an initial public offering, the mechanism for successfully completing an IPO is not trivial. In this section, we outline the process by which companies are brought to market in an initial public offering.

When a company wishes to make a public offering, its typical first step is to select an investment bank to advise it and to perform underwriting functions in connection with the issue. During the selection process, commonly referred to as the bake-off, the company considers potential investment banks' general reputation, their expertise, and their quality of research coverage in the company's specific industry. The selection also depends on whether the issuer would like to see its securities held more by individuals or by institutional investors (i.e., the investment bank's distribution expertise). Prior banking relationships the issuer and members of its board (especially the venture capitalists) have with specific firms in the investment banking community also influence the selection outcome. Often, the selection process is a two-way affair, with the reputable investment banker choosing its clients at least as carefully as the company should choose the investment banker.

The most common type of underwriting arrangement is the "firm commitment" underwriting in which the underwriter "purchases" the entire issue of securities from the issuer and then attempts to resell the securities to the public. We put "purchases" in quotes because the underwriter, at best, purchases the shares from the issuer only on the night before it goes public, when most of the uncertainty has been resolved. The difference between the price at which the

[5] This section is largely based on Elis, Michaely, O'Hara (1999).

underwriter buys and subsequently sells the issue is called the gross spread and in the majority of cases represents 7% of gross proceeds.

Public offerings can be managed by one underwriter (sole managed) or by multiple mangers. The trend in the last two decades has been toward greater number of underwriters acting as co-managers; and at the same time toward fewer number of investment banks as part of the syndicate (Corwin and Schultz, 2005). When there are multiple managers, one investment bank is selected as the lead or book-running manager. The lead manager almost always appears on the top left of the cover of the prospectus, and it plays the major role throughout the transaction. The managing underwriter makes all the arrangements with the issuer, establishes the schedule of the issue, and has the primary responsibility for the due diligence process, pricing and distribution of the stock. The lead manager is also responsible for assembling a group of underwriters (the syndicate) to assist in the sale of the shares to the public. Members of the syndicate are paid a portion of the gross spread for their participation.

Figure 9 reports dynamics of the number of lead managers and the co-managers for all IPOs between 1972 and 2015. The majority of IPOs in 1970s were managed by one lead underwriter. Over the years the mean number of book-running managers rises to 3.2 per offering. The number of co-managers in the offering increases as well; and in the last decade the IPO is managed by six underwriters on average.

Panel B of Figure 9 provides more detail on syndicate composition. We begin this analysis in 1997, because Corwin and Schultz state that the SDC data on these variables are unreliable prior to this. Since 1997, at the same time as the number of lead managers and co-managers has increased (as shown in Panel A), total syndicate size has decreased (as shown in Panel B). This divergence is driven by changes in the participation of other syndicate members. Companies going

public in 1997 had an average 14 other syndicate members, which decreased steadily to 8 for companies going public in 2002. Since 2002, SDC reports zero other syndicate members. Hand-checking of all prospectuses among 2015 IPOs verifies that there were no other syndicate members.

The lead underwriter, the co-managers and the other syndicate members all receive compensation from the company for being involved in the IPO process. This compensation comes from the gross spread—the difference between the price the securities are bought from the issuer, and the price at which they are delivered to the public. The lead underwriter receives a fee for its efforts that is typically 20% of the gross spread. The second portion of the spread is called the "selling concession", and it is the amount paid to the underwriter and other syndicate members for actually selling the securities. This is typically equal to 60% of the gross spread. Each syndicate member receives a selling concession based on the amount of the issue it sells to its customers. Institutions occasionally directly designate the selling concession credit associated with their stock purchase to a specific syndicate member regardless of who actually sold the stock. These designated orders usually arise as compensation for sell side equity research services performed by investment houses. (These research services are not about the upcoming IPO but rather about research on other firms that has been provided by the sell side analysts.) The remaining portion of the gross spread (approximately 20%) is used to cover underwriting expenses (underwriter counsel, road show expenses, etc.). If anything remains after deducting all expenses, it is divided proportionately among the underwriter and syndicate members depending on the amount of securities each underwrote.

One of the lead underwriter's first-agenda items (usually before any significant expenses have been incurred) is to draft a letter of intent. An important aspect of the letter of intent is to

protect the underwriter against any uncovered expenses in the event the offer is withdrawn either during the due diligence and registration stage, or during the marketing stage. Thus, the letter of intent contains a clause requiring the company to reimburse the underwriter for any out-of-pocket expenses incurred during the process. Another important aspect of the letter is to specify the gross spread or the underwriting discount. In most cases, the gross spread is 7% of the proceeds (see Chen and Ritter (2000) for an excellent discussion of the uniform size of the gross spread).

Figure 7 reports the time trend in the gross spread. The portion of offerings with a gross spread above 7% drops sharply after 1980 while the percent of companies with a spread below 7% increases. In the last decade approximately half of companies have a spread of exactly 7%, with most other companies having a spread below 7%. Figure 8 shows the dynamics of the gross spread for each of three size groups: IPOs with gross proceeds up to $30M, IPOs with gross proceeds between $30M and $120M; and IPOs with gross proceeds above $120M. The average spread for the medium-size companies constantly stays on the 7% level, while the spread of large companies tends to decrease.

The letter of intent also typically includes: a commitment by the underwriter to enter into a firm commitment agreement (or other underwriting agreements, as the case may be); an agreement by the company to cooperate in all due diligence efforts, and to make available all relevant information to the underwriter and its counsel; and a commitment by the company to grant a 15% overallotment option to the underwriter.

The over-allotment option is an integral part of almost any underwriting agreement, allowing the underwriter the option to sell an additional 15% of the issue. In practice the underwriter sells 115% of the size of the original issue at the time of the offer (effectively selling 100% of the issue and short-selling an additional 15% of the issue). If the issue is successful and

its price goes up in the aftermarket, the underwriter exercises the overallotment option, receives the proceeds from the additional 15% of shares, and covers its short position. Alternatively, if the issue is less successful, the underwriter covers its short position in the aftermarket by buying back some of the overallotment shares, thereby supporting the price of the newly traded firm in the market. By regulation, the underwriter is permitted to buy back shares at any price less than or equal to the offer price. (For a more detailed description of the over-allotment option and how it is being used, see Ellis, Michaely and O'Hara (2000)).

It is important to note that there is no guarantee of the final offering price (and, in most cases, no mention of any valuation) in the letter of intent. The letter of intent remains in force until the Underwriting Agreement is executed at pricing, on the night before the firm goes public. Only then is the underwriter firmly committed to buy the securities at a specific price from the issuer. By that point, the underwriter has very good indications on how successful the deal will be and at what price the market will be willing to buy the deal. This knowledge allows the underwriter to determine a price for the issue. It also allows it to "firmly commit" to buy the shares at a price, with minimal risk exposure.

The Securities Act of 1933 mandates that the company and its counsel draft and file with the SEC a registration statement, based upon an outline that is frequently provided by the lead underwriter. It usually takes several weeks and many meetings of the working group (the company management, its counsel and auditors, the underwriters, the underwriters' counsel and accountants) before the registration statement is ready to file. The registration statement is circumscribed by Section 5 of the Act, which gives specific requirements for the registration statement. The registration statement consists of two parts: the prospectus, which must be furnished to every purchaser of the securities, and "Part II" which contains information that need

not be furnished to the public through the prospectus, but is made available for public inspection by the SEC. (Part II contains information such as other expenses on issuance and distribution, indemnification of directors and officers, and recent sales of unregistered securities.)

The purpose of the registration and disclosure requirements is to ensure that the public has adequate and reliable information regarding securities that are offered for sale. To achieve this, the underwriter has a "due diligence" requirement to investigate the company and verify the information it provides about the company to investors. Companies have some ability to exclude information from the prospectus that is deemed to be sensitive for competitive reasons. As discussed by Boone, Floros and Johnson (2016), companies can request that certain information be given confidential treatment, e.g., details about a product or service, trade secrets, etc. While such 'redactions' of proprietary information decrease transparency and thus may be costly to companies, they have the benefit of protecting the company from disclosing competitive secrets.

The Securities Act also makes it illegal to offer or sell securities to the public unless they have first been registered. It is important to note, however, that the SEC has no authority to prevent a public offering based on the quality of the securities involved. It only has the power to require that the issuer disclose all material facts. As a safeguard, the Securities Act requires that the registration statement be signed by the directors and principal officers of the issuer as well as the underwriters, accountants, appraisers and other experts who assisted in the preparation of the registration statement. Any purchaser of the securities who is damaged as a result of a misstatement or omission of a material fact in the registration statement may sue these signatories under Section 11 of the 1933 Securities Act. Such disclosure-based lawsuits have been relatively constant at around 6% of the IPOs (see for example Lowry and Shu, 2002).

The version of the registration statement that is filed with the SEC is referred to as the preliminary prospectus (or "Red Herring".) The preliminary prospectus is one of the primary tools in marketing the issue. During the period after the filing, the SEC examines the registration statement and engages in a series of communications with issuer regarding any changes necessary to bring about SEC approval. The company typically responds to these comments and issues through letters to the SEC and via amended prospectuses. This back and forth between the issuer and the company can, and often does, continue through multiple rounds. Each round of correspondence between the company and SEC takes about 30 days on average, Figure 11 shows the relationship between length of registration and number of rounds. Our knowledge of how the SEC affects the IPO process is limited. A recent paper by Lowry et al (2016) tries to fill this gap by examining the role of the SEC from the time the company files it prospectus until the IPO. Their findings highlight the ways in which the SEC influences the information that companies provide to investors during the IPO process. Throughout the filing period, the SEC expresses its concerns about the validity and completeness of information provided in each company's prospectus. Typically, this is an interactive process of multiple rounds, where the SEC expresses its concerns and asks for more information in letters to the company, and the company adjusts its prospectus accordingly. The benefits of SEC reviews can be substantial: the regulatory process serves as a monitoring device and ensures efficient and fair information revelation practices. However, the costs can be substantial as well. A prolonged process with the SEC may force the company to reveal private information that will reduce its competitive advantage. It also distracts management from the running of the company and may delay the entire process.

Lowry et al (2016) find evidence that regulators play an active role around the time of the IPO. Companies receive between one and thirteen comment letters, with each letter having

between two hundred and over seven thousand words. The greatest number of SEC questions relate to requests for clarification on the business model and about the uncertainties associated with it. The paper also finds that more complex companies tend to receive longer letters from the SEC and a greater number of letters. Companies with higher quality advisors tend to receive fewer questions on issues related to valuation and business description, while companies with a more uncertain tone in the prospectus receive significantly more questions on both these topics. Finally, companies with a higher likelihood of fraud receive significantly more questions related to accounting.

Once the company has addressed the substantial issues raised by the SEC, the marketing of the offering begins. Often the prospectus is sent to sales people as well as to institutional investors around the country. At the same time, the company and the underwriter promote the IPO through the road show, in which the company officers make numerous presentations to (mainly) institutional investors as well some retail salespeople. A typical road show lasts 3-4 weeks and includes two or more meetings a day.

As the road show progresses, the underwriter receives indications of interest, the majority of which tend to be from institutional investors. The indications of interest by individual investors and by institutions differ along several dimensions. First, retail investors typically submit a "market order" in which only the quantity desired is stated. Institutions, on the other hand, sometimes submit limit orders where the quantity demanded is subject to a maximum price. Second, retail orders are received earlier than institutional orders since institutions prefer to wait to a later stage of the process before submitting their orders. Third, in some cases, institutions submit an order with a commitment to purchase more shares in the open market if their order is fulfilled, a process that is referred to as laddering (see Griffin, Harris, and Topaloglu (2007) for a

detailed analysis of laddering). These differences between retail and institutional investors may affect the investment bank's marketing strategy. However, regardless of the source of the indication of interest, at this stage, prior to the effective day, no shares can be officially sold, so any orders submitted are only indications of interest and are not legally binding.

The registration and marketing process can take several months, and it is therefore impossible for the underwriter to include certain information (such as the final IPO price, or the exact number of shares to be offered) in its initial filing with the SEC. The initial price range is typically included in one of the amended prospectuses, which is filed after the company has addressed the majority of the SEC's comments and before the roadshow begins. If the company and its underwriter learn particularly positive or negative news during the roadshow period, then the company issues an amended prospectus with an amended price range. Specifically, the company must increase (decrease) the price range if the expected offering proceeds will be more than 20% above the maximum amount (more than 20% below the minimum amount) previously designated. Figure 10 reports the distribution of the length of the IPO process from the time of the filing of the initial prospectus until the IPO. The number of days between the filing and the IPO increases from 50 days in the mid-1980s to 120 days in the last decade.

On the day prior to the effective date, after the market closes, the firm and the lead underwriter meet to discuss two final (and very important) details: the offer price and the exact number of shares to be sold. Particular attention during the pricing decision is given to the order books (where institutions and other investors' indications of interest are recorded). Discussions with investment bankers indicate that they perceive that an offer should be two to three times

oversubscribed to create a "good IPO".[6] There is extensive evidence (see, for example, Ritter (1991)) that IPOs tend to be "underpriced". This means that investors in an IPO can expect the price to rise on the offer day, a characteristic that enhances demand for the issue. From the company's perspective, such underpricing "leaves money on the table" in the sense that the company is not getting the full value for its shares, but it may be preferable for the company if it guarantees that the issue succeeds. Why firms are willing to leave so much money on the table is one of the biggest puzzles surrounding IPOs.

After those final terms are negotiated, the underwriter and the issuer execute the Underwriting Agreement, the final prospectus is printed, and the underwriter files a "price amendment" on the morning of the chosen effective date. Once approved, the distribution of the stock begins. On this morning, the company stock opens for trade for the first time. The closing of the transaction occurs two to three days later, when the company delivers its stock, and the underwriter deposits the net proceeds from the IPO into the firm's account.

However, the IPO is far from being completed. Once the issue is brought to market, the underwriter has several additional activities to complete. These include the after-market stabilization, the provision of analyst recommendations, and making a market in the stock. The stabilization activities essentially require the underwriter to support the stock by buying shares if order imbalances arise. This price support can be done only at or below the offering price, and it is limited to a relatively short period of time after the stock has began trading. Interestingly, during this period, the standard prohibitions against price manipulation do not apply to the underwriters, and they are free to trade so as to influence the price of stock. (See Ellis Michaely and O'Hara,

[6] This "pricing meeting" will never be held on Friday since the underwriter does not want to take the risk of pricing a firm on Friday and being able to sell the firm only on Monday. Indeed, there are practically no firm commitments IPOs on Mondays.

2000 and Aggarwal 2000 for an in-depth analysis of the underwriters' activities in the post-IPO period). In general, the underwriter will continue to actively trade the stock in the months and years following the offering. By "making a market in the stock", the underwriter essentially guarantees liquidity to the investors, and thus again enhances demand for the shares.

The final stage of the IPO begins 25-40 calendar days after the IPO when the so-called "quiet period" ends. (The exact length of the quiet period has varied over time and also depends on issue size). This "quiet period" is mandated by the SEC, and it marks a transition from investor reliance solely on the prospectus and disclosures mandated under security laws to a more open, market environment. It is only after this point that underwriters (and other syndicate members) can comment on the valuation and provide earnings estimates on the new company. The underwriter's role thus evolves in this after-market period into an advisory and evaluatory function (e.g., see Michaely and Womack (1999), Cliff and Denis (2004), Ljungqvist, Marston, and Wilhelm (2006, 2009), for an evaluation of the role of the underwriters' post-issuance recommendations).

Importantly as a response to the low IPO volume since 2000 and in an attempt to jump-start the market, some of the regulations relevant to IPOs have recently changed. In April 2012, the Jumpstart Our Business Startups Act (JOBS Act) was enacted to help revitalize the initial public offering (IPO) market, especially for small firms. Most importantly, it allows small firms (less than $1b in annual revenues) to file IPO draft registration statements confidentially and thus reduce the risk associated with the IPO process by enabling issuers to disclose information to the SEC, but not competitors. Further, partially motivated by the argument that internal controls imposed by the Sarbanes-Oxley Act of 2002 (SOX) increased the burden on small firms who want to become public, the JOBS act exempts small firms from certain accounting and disclosure requirements.

Dambra, Field, and Gustafson (2015) document increased US IPO activity in the two years after the JOBS act, not found on other active IPO markets around the world. Further the higher IPO volume is concentrated in small IPOs for which the JOBS act applies. Equally interesting Dambra et al (2015) find that the risk reduction is likely to be the more dominant reason for the increased IPO activity in the post JOBS act era. Specifically, they find a shift in IPO activity towards firms associated with high proprietary costs of disclosure (measured by research intensity and industry concentration). Small firms have been using the de-risking provision quite often and the JOBS act seems to have had a significant impact in the IPO landscape.

Overall, the initial public offering process thus involves a complex combination of tasks by the company, the underwriter, the syndicate members and regulators. Throughout the process, the company relies on the underwriter's expertise to market, price, distribute, stabilize, and support the issue. The completion of the process provides new capital for the firm, and a new investment opportunity for the public. In the following sections we discuss many of these issues (such as the role of the underwriter, and the pricing and performance of IPOs as an investment vehicle) and related them to the rich academic literature on IPOs in more detail.

## 4. IPO Pricing and the role of the underwriter

Initial Public Offerings (IPOs) are underpriced on average. Over our sample period, less than one out of every five IPOs has negative first-day returns, and the average return to purchasing an IPO at the offer price and selling at the end of the first day is 19.1%. Many of the theories advanced in the literature to explain this phenomenon are based on the existence of information asymmetry between the underwriter, the company, and/or the market. Each party has a certain information advantage, but at the same time lacks other critical information. Management of the company arguably has the most detailed information about the company, but they likely find it difficult to credibly convey this information to the market without disclosing valuable information to competitors. In contrast, market participants as a whole know more than the firm about one critical input to the IPO pricing process: aggregate demand for the firm's shares. Most of the fundamental models of IPO underpricing focus on one of these levels of information asymmetry.

A second critical component of most of the fundamental models of IPO underpricing concerns the role of the underwriter, which is consistent with the fact that nearly every company issuing public equity for the first time relies on the services of an underwriter. The precise role of the underwriter is a function of the IPO mechanism and process, which has varied over time and across countries. The majority of our discussion of IPO pricing focuses on the bookbuilding mechanism, which represents the dominant method of bringing companies public in the US and increasingly around the world. However, in subsection 4.5 we consider differences between bookbuilding and auctions. A distinguishing feature of bookbuilding is that the underwriter both sets the price at which the company goes public and controls allocations. As discussed in detail in this section, underwriters' control over both these factors generates potential advantages as

well as potential disadvantages. At a minimum, underwriters' incentives in setting the offer prices are not straightforward.

*4.1 Information asymmetry between the company and investors: Rock model*

Rock's (1986) model of underpricing is based on information asymmetry between the company and investors. In the model, the underwriter controls price but not allocations, meaning it is not strictly consistent with bookbuilding. Specifically, the model assumes that the company has superior information to any particular investor, but some investors are better informed than others. There are two classes of investors: informed and uninformed. The informed investors are able to determine whether the firm is high or low quality (i.e., given the offer price, whether the offering is overpriced or underpriced), and they only subscribe to the high quality issues. In contrast, uninformed investors are unable to determine the quality of the firm, and they subscribe to all or no offers. Because the informed investors only subscribe to the high quality issues, uninformed investors receive a disproportionate allocation of the low quality issues. Hence, in order to ensure that the uninformed investors receive a fair rate of return and thus participate in the market, issues must be underpriced on average.

Because the underwriter controls price but not allocations, this model is only partially consistent with the bookbuilding mechanism. Nevertheless, it receives wide empirical support in both the US and in other countries that employ bookbuilding. For example, Michaely and Shaw (1994) find that master limited partnerships (MLPs), which are known to have limited institutional participation and thus greater homogeneity among investors, have significantly lower underpricing. Moreover, consistent with Beatty and Ritter's (1986) extension of Rock's

model, issues with lower information asymmetry, such as issues backed by higher ranked underwriters, also have lower underpricing.

Amihud, Hauser and Kirsh (2003) are able to conduct a particularly powerful test of Rock's model, using data from the Tel Aviv Stock Exchange. They have the subscriptions of each investor for a sample of IPOs, and allocations were made by equal proration during their sample period. Consistent with Rock's model, individual investors received larger allocations in overpriced IPOs. Further, the number of investors submitting orders is higher in underpriced offerings, which is consistent with both informed and uninformed investors participating in more underpriced offerings, while only the latter investors participate in overpriced offerings. However, the average underpricing of 12% was not sufficient to compensate these uninformed investors for the allocations they received, and they earned a negative average initial returns across all the IPOs in which they invested.

Empirical tests of Rock's model have also focused on the extent to which higher quality advisors, which should lower the information asymmetry associated with the company, contribute to lower underpricing. All else equal, a company that has the backing and thus the certification of a higher quality underwriter should have less information asymmetry and therefore lower initial returns. In a similar vein, backing by a venture capitalist should also lower underpricing. Early tests of these idea using samples of IPOs in the 1970s and 1980s, including both Carter and Manaster (1990) and Michaely and Shaw (1994), supported these predictions.[7] However, more recent papers lack a consensus on the robustness of those findings

[7] Carter and Manaster's (1990) rankings, as updated by Carter, Dark and Singh (1998) and Loughran and Ritter (2004) are based on placements on tombstone ads, while Megginson and Weiss's rankings are based on underwriter market share. Loughran and Ritter (2004) offer a more updated ranking (available on Jay Ritter's website) that is based on both tombstone ad placements and conversations with practitioners.

across different time periods. It seems that in the more recent period some of these relationships, such as the impact of VCs on IPO underpricing, have changed signs.

Beatty and Welch (1996) find that higher ranked underwriters began to have a *positive* effect on underpricing in the 1990s. Loughran and Ritter (2004) conjecture that this reflects a change in issuers' objective function as issuers became increasingly focused on analyst coverage: an issuer may be willing to accept higher underpricing as the cost of higher quality analyst coverage. Because the higher quality analysts tend to be concentrated among the banks that represent the highest quality underwriters, this will cause a positive relation between underwriter rank and underpricing. In contrast, Habib and Ljungqvist (2001) argue that the observed positive relation between underwriter rank and underpricing stems from endogeneity, i.e., the highest quality banks are more likely to underwrite the IPOs of firm types that tend to have higher information asymmetry and underpricing. They conclude that after controlling for the endogeneity, there is no evidence that the higher ranked underwriters underprice IPOs by a greater amount (in the second stage regression of underpricing on rank, the coefficient on rank is insignificantly negative). While we agree that endogeneity is likely to be an issue, and underwriters and companies are not matched randomly, we are not totally convinced by Habib and Ljungqvist's choice of pre-IPO assets and pre-IPO earnings as instruments. These variables are likely to be related to firm information asymmetry and thus to expected underpricing, meaning they may not satisfy the exclusion criterion.

In sum, using firm characteristics as proxies for information asymmetry, Rock's model as extended by Beatty and Ritter receives broad empirical support. It is commonly viewed as one of the fundamental models of underpricing. While in theory higher reputation intermediaries should decrease the level of information asymmetry and thus contribute to lower underpricing,

there are many confounding factors that make it difficult to ascertain the true nature of these relationships.

### *4.2 Information production and collection by underwriters: Benveniste and Spindt model*

Benveniste and Spindt's (1989) model focuses more directly on underwriters' control over both price and allocations, as is the case in bookbuilding IPOs. Key aspects of the model include the information advantage of market participants, the decisions of investors whether to provide information to underwriters, and the fact that underwriters will be better able to forecast aggregate market demand if they have this information. After determining a preliminary estimate of firm value, the underwriter and the firm go together on a road show to market the issue to prospective institutional investors. The underwriter wants to learn about investors' valuations, so that it can more accurately price the deal. If investors believe that the company is worth more than the original estimate, the underwriter would be able to raise the offer price and hence raise more money for the company (and earn greater fees for itself).[8] However, investors have an incentive not to share this information; they prefer to buy the offer at a lower price and pocket a higher return. Benveniste and Spindt note that the repeated game nature of this problem enables a solution. The equilibrium outcome is for investors to share the positive information, but for underwriters to only partially incorporate this information into the final offer price. Investors benefit from the fact that the issues are still underpriced, enabling them to earn a positive abnormal return. Underwriters benefit from the more accurate pricing compared to what

[8] While beyond the Benveniste and Spindt model, we note that the precise relation between the offer price and underwriters' incentives is complex. Underwriters' direct compensation represents a fraction of proceeds raised, meaning a higher offer price will result in higher fees. However, the direct benefits of a higher offer price (and thus higher proceeds) are generally perceived to be outweighed by the benefits of the indirect compensation related to allocating more underpriced shares to favored clients. These issues are discussed in more detail in section 4.4.

they would have achieved without investors' information, and hence they reward investors that provide this information with higher allocations of the underpriced shares.

Extending this model further, Sherman (2000) and Sherman and Titman (2002) focus on the extent to which underwriters can motivate investors to engage in information collection on these heretofore private firms, about which there tends to be little readily available public information.[9] Under the assumption that there are costs to investors of collecting information, an underwriter that strives for both a high offer price and high price accuracy will optimally underprice new issues; the incentive of receiving allocations of underpriced shares causes investors to engage in this costly information collection and to disclose their information to underwriters. Thus, similar to Benveniste and Spindt, the result is that underwriters are able to more accurately price the issue.

An additional implication of both Sherman (2000) and Sherman and Titman (2002) is that the underwriter will optimally limit the investor pool as a means of controlling information collection costs, a conclusion that Yung (2005) also reaches after endogenizing the information production of both banks and investors. In addition to limiting the size of the investor pool, Sherman (2000) concludes that there are reasons for underwriters to build long-term relationships with investors and to favor these regular investors in allocations.

Empirical evidence on the extent to which underwriters rely on the information production/collection of investors in book building offerings is mixed. Hanley (1993) provides the first empirical test of an important implication of the Benveniste and Spindt model. If information learned during the filing period is only partially incorporated into the offer price, then there should be a significant positive relation between the price update and the initial return,

[9] They argue that information collection is a more binding constraint than truth telling, which is the focus of Benveniste and Spindt.

where the price update is measured as the percentage difference between the midpoint of the filing range and the offer price, and the initial return is measured as the percentage difference between the offer price and the first aftermarket closing price. Consistent with this logic, Hanley finds that offers that are priced above the upper bound of the price range have average initial returns of 20.7%, compared to 0.6% for offers that are priced below the lower bound of the range. This pattern is quite stable over time. As shown in Table 3, across the entire sample period of 1983 to 2015, we find that the analogous initial returns are 56.8% versus 2.4%, respectively. As we discuss later in this section, while this result is consistent with the Benveniste and Spindt model, it is also consistent with other explanations of why IPOs are underpriced.

An obstacle to more detailed tests of the Benveniste and Spindt model relates to the general lack of data on both allocations and the underwriter's order book. While no researcher has been able to obtain detailed U.S. data on underwriters' books containing investors' indications of interest, several papers have obtained such data on samples of European offerings. Earlier papers were based on relatively small samples and found conflicting results. Cornelli and Goldreich (2001) find that bidders who include limit prices and who revise their bids obtain more shares, and Cornelli and Goldreich (2003) find that bids by large, regular bidders who include limit prices affect the issue price. However, Jenkinson and Jones (2004) find little support for the importance of information production. They find that the extent to which an investor is expected to be a long-term holder of the stock is substantially more important than whether or not they submit more informative bids. This conclusion is further substantiated in a subsequent survey by the same authors (Jenkinson and Jones, 2009).

More recently, Jenkinson, Jones and Suntheim (2016) conduct a broader study, which is based on detailed information related to bids, allocations, and fees for 220 IPOs predominantly in Europe between January 2010 and May 2015. They find some support for bookbuilding theories, i.e., that investors who provide more information through bids are rewarded with larger bids. First, there is weak evidence that price-sensitive bids (as opposed to strike bids) receive higher allocations, but the effect varies substantially across banks and allocations in some banks are completely independent of bid type. Second, investors who participate in pre-IPO meetings, an interaction that is potentially associated with information exchange, tend to receive higher allocations. Third, regular investors tend to receive larger allocations. However, Jenkinson et al also find substantial evidence that factors other than information exchange affect allocations; we discuss these finding in subsection 4.4 on conflicts of interest.

In light of the lack of detailed US data, several papers have attempted to assess the extent of investor information production through other means. For example, Wang and Yung (2011) posit that higher ranked underwriters should have an advantage in information production, either because of greater networks of investors or greater skill. Consistent with this conjecture, they find that firms brought public by higher ranked underwriters have greater filing price revisions and lower secondary market volatility. Price revisions of firms brought public by less reputable banks cluster on exactly zero dollars - the partial adjustment phenomenon is primarily due to higher ranked underwriters. One could argue, however, that more reputable underwriters, might be able to gather more precise information even before the roadshow begins, through the due diligence process, through conversations with more qualified sell-side analysts, etc, Such advantages would cause their initial price ranges to be more precise, resulting in fewer revisions.

Wang and Yung's findings on the magnitude of high reputation banks' price revisions may be subject to more than one interpretation.

As an alternative way to test the extent of information production, several papers have examined either IPO allocations or post-IPO holdings. Bookbuilding theories predict that investors who engage in the most information production should obtain the largest allocations. Consistent with this, Aggarwal, Prabhala, and Puri (2002) find a strong positive relation between institutional allocations and first day returns. During their 1998 – 1999 sample period, institutions are allocated approximately 75% of underpriced issues on average, compared to an average 55% of overpriced issues.[10] In addition to obtaining substantial allocations, Chemmanur, Hu and Huang (2010) are able to verify that institutions earn substantial profits from these IPO investments. They find that institutions earn an average 67% abnormal return on their IPO investments, calculated based on numbers of allocated shares and detailed transaction data on when they sold the shares.[11] However, as discussed in detail in subsequent subsections, agency-related issues such as favoritism or quid-pro-quo for other services are very likely to contribute to these relations. In sum, these studies in aggregate provide some support for the Benveniste and Spindt model of bookbuliding, but suggest that factors other than those incorporated in this model likely have a greater influence on the IPO process.

Both Loughran and Ritter (2002) and Lowry and Schwert (2004) highlight two additional implications of the Benveniste and Spindt model. First, the model implies that private information should be partially incorporated into offer prices, but that public information should

[10] As noted by the authors, this finding is also consistent with Rock's model, under which informed investors are able to avoid the lemons.

[11] Boehmer, Boehmer, and Fishe (2006) find further that institutions receive higher allocations in IPOs with the highest long-run performance. However, the importance of this to institutions is unclear, given Chemmanur et al's finding that institutional investors are not penalized for flipping shares soon after the IPO, a phenomenon commonly referred to as flipping.

be fully incorporated. In other words, underwriters have no reason to reward investors by only partially incorporating public information into the offer price; underwriters can observe this information themselves and thus have reason to rely on institutional investors. Second, while positive private information should only be partially incorporated, negative information should be fully incorporated. Both underwriters and institutional investors want to avoid overpriced issues (underwriters' incentives are related to difficulty of selling the issue and reputational effects). Both Loughran and Ritter (2002) and Lowry and Schwert (2004) empirically test and find support for the predicted asymmetry effect of positive versus negative information. However, there exists less consensus on the effects of public versus private information.

Loughran and Ritter (2002) employ a series of univariate regressions to examine the effects of public versus private information. First, they note that a regression of the percentage change between the first aftermarket closing price and the midpoint of the filing range represents an estimate of the firm beta, which they estimate to be 2.37 on average. Second, they argue that if public information is completely incorporated into the offer price, then a regression of the percentage change between the offer price and the midpoint of the filing range on market returns should yield a similar coefficient estimate on market returns. However, in contrast to this prediction, they obtain a coefficient estimate of 0.76, and based on this they conclude that only 32% of the public information is incorporated into the offer price, a finding that is inconsistent with the Benveniste and Spindt model.

Lowry and Schwert (2004) argue that a stronger test of the effects of public versus private information should include proxies for both in one regression, due to the likely positive correlation. The price update, measured as the percentage difference between the midpoint of the filing range and the offer price, should incorporate the effects of both public and private

information that becomes available over the filing period, while market returns should capture just public information. Regressing initial returns on both these factors (as well as a variety of other firm- and offer-specific characteristics), the coefficient on market returns should capture the effects of public information and the price update coefficient should isolate the effects of private information. Using this framework, Lowry and Schwert conclude that nearly all public information is incorporated into prices. A one standard deviation change in market returns (approximately 11%) is associated with an 0.08% standard deviation change in initial returns (1.6%). In contrast, a one standard deviation change in the price update is associated with an 0.40 standard deviation change in initial returns (8%).[12]

In sum, to a large extent the process by which underwriters set the offer price is yet unclear to the public and academics alike. The lack of publicly available allocation data raises questions regarding whether some investors have advantages over others, for example if certain information is not fully incorporated into price, and whether post-IPO price dynamics are predictable as a result. For example, Cornelli and Goldreich find that when there is more disagreement about the offer price, i.e., the elasticity of limit quotes is lower, the offer price tends to be lower and post-IPO market returns higher. Should more information be available? In today's world of increased disclosure requirements and increased attention from regulatory authorities on disclosure, these questions provide ample opportunity for future research.

### *4.3 Information production more broadly*

As highlighted in the previous subsection, empirical support for information production by the lead underwriter during the bookbuilding period is mixed, and despite many efforts it is

[12] Lowry and Schwert find that the coefficient on market returns is positive and statistically significant, but the economic significance is trivial.

largely circumstantial: papers based on samples of European IPOs find conflicting results regarding both the prevalence of informed bids and the extent to which such informed bids are rewarded with higher allocations. However, there is strong evidence that institutions, on average, receive higher allocations than retail investors, and institutions earn high profits on these allocations. One possible explanation for this mixed evidence relates to uncertainty regarding the time of information production and/or revelation. There are three periods of time during which information is potentially produced and revealed: prior to the IPO filing, during the bookbuilding period, and in the secondary market. While the above-cited papers focus on information production during the second period, both Jenkinson, Morrison and Wilhelm (2006) and Hanley and Hoberg (2010) emphasize the potential for information production during the first period.

It is quite clear that in the first period, for example during the due diligence process, much information about the issuers is gathered by the underwriters: they talk with management, they talk with suppliers, they talk with the relevant VCs and other stake holders, in conjunction with the lawyers and auditors they thieve through companies documents, they examine inventories and examine the company's accounting and governance. The underwriters combine this information with their assessment of industry and market valuations and eventually come up with a value range for the company. Hanley and Hoberg's (2010) analysis of prospectuses is consistent with certain underwriters and managements engaging in meaningful pre-filing information production. They find that the uniqueness of the text in the prospectus, specifically in the MD&A section, is related to more accurate offer prices, i.e., to smaller absolute value of price updates and to lower initial returns. The authors further find that the uniqueness of information in the prospectuses is positively related to underwriter fees, which they interpret as

being consistent with information production rather than a decision to simply disclose more information. Moreover, information related to inputs into valuation models is found to be most relevant, e.g., finance and accounting terms, product market, governance, etc. Jenkinson et al (2006) suggest that the extent of information collection prior to the IPO filing is even more extensive in Europe, where regulations governing pre-IPO (and prior to the intent to file an IPO) interactions between investors and issuers are less stringent.

Consistent with this idea that information production can occur prior to the IPO, a number of countries have variations in issuing strategies, which offer potential benefits at least for certain types of firms. For example, firms in the United Kingdom use a two-stage issuing strategy, where they list without issuing equity and then subsequently issue.[13] Derrien and Kecskes (2007) conclude that this first-stage trading reduces valuation uncertainty, resulting in lower initial returns. Similarly, Aussenegg, Pichler, Stomper (2006) analyze pre-IPO trading that occurs in the German market, and they find that this 'when-issued' trading reveals substantial information, thereby reducing costs of bookbuilding. However, they also conclude that bookbuilding still provides incremental information. Finally, Chang, Chiang, Qian and Ritter (2016) focus on the pre-market in Taiwan, and in a similar vein conclude that pre-market prices contain substantial information regarding post-IPO prices

While the theoretical literature focused on the relationship between "the underwriter" and investors, Corwin and Schultz (2005) examine the determinants of syndicate composition. Their results highlight the importance of relationships among banks: banks that have worked together in syndicates in the past are likely to also work together in subsequent syndicates. They find that the composition of this syndicate is related to the amount of information production. The causal

[13] Because no primary shares are sold, the only shares available for sale are secondary shares, i.e., shares of current shareholders such as owners, managers and employees.

interpretation would be that larger syndicates tend to result in more information production, as measured by the likelihood of the offer price being revised. However, it is difficult to differentiate this causal story from one in which firms whose value is more uncertain choose to work with larger syndicates.

Corwin and Schultz also highlight the changes in syndicates over their 1997 – 2002 sample period, with total syndicate size decreasing but the number of co-managers increasing. We collected more data on the syndicate size and find that since 2002, total syndicate size has continued to decrease, rather substantially: median syndicate size is eleven in 2002 compared to only five in 2015.[14] Interestingly, the number of co-managers has also decreased, from a median of three in 2015 to a median of two in 2015. However, the number of book managers has increased over this period, going from a median of one in 2002 to a median of three in 2015.[15] While 29% of IPOs in 2002 had multiple book managers, that number had increased to nearly 90% by 2015. The contrasting trends are explained by a strong decline in the number of co-managers and other syndicate members. In fact, across the 125 IPOs in 2015, none had other syndicate members (as recorded in SDC and manually verified by examining the prospectuses). Figure 9 shows the evolution of the syndicate over time. The determinants of both syndicate size and the number of book managers are interesting and seem to be understudied. It would be useful to better understand the reasons for the variation both across time and across IPOs.

[14] These statistics are based on SDC data combined with manual checking of prospectuses. We confirm that SDC data on syndicate size are largely correct for these years, with the exception that actual syndicate size equals SDC's reported syndicate size minus the number of underwriters listed as Global Coordinator (because these underwriters are included in either the book manager or joint book manager categories).

[15] Book managers, coded as book manager or joint book manager in SDC, receive the greatest share allocations. We would expect joint leads to also receive relatively large share allocations (i.e., larger than co-managers), but in more recent years the differentiation between joint leads and other members of the syndicate (e.g., co-managers) in SDC is less clear.

Overall, this body of literature emphasizes the advantages that underwriters have in ensuring that investors both collect information on the firms going public and share the information with underwriters. In particular, the repeated nature of IPO-related interactions between underwriters and investors, underwriters' access to both company management and to internal company documents, and underwriters' expertise in valuations are key factors. However, in spite of these advantages, Lowry, Officer and Schwert (2010) show that underwriters have limited ability to accurately value IPOs. While various theories suggest that underwriters have incentives to underprice IPOs, it is difficult to conjecture that they would gain by overpricing these offerings. Nevertheless, approximately one-third of IPOs are trading below their offer price one month after the IPO. Moreover, measures of mis-pricing are significantly related to the difficulty of valuing the company, for example company-level uncertainty and information asymmetry. They conclude that while underwriters may gather a lot of information in the first stage (the due diligence process) and may perhaps get valuable feedback about demand (a la Benveniste and Spindt) from outside informed investors, at the end of the day, IPO pricing is still very imprecise probably because the process lacks sufficient detail about one critical element: market-wide demand for these new issues. In sum, while underwriters and institutions do engage in information production, the aggregation of information through this process and the ability to value a heretofore private firm is limited. One should wonder whether an auction type process, where all market participants have a chance to bid, would improve the process along these dimension. We discuss this possibility in more depth in section 4.5.

### *4.4 Conflicts of Interest between underwriters and issuing firms*

While papers advocating the advantages of bookbuilding tend to focus on underwriters' role in information production, a balanced discussion must also consider the disadvantages of bookbuilding that stem from underwriters' conflicts of interest. Unfortunately, the precise features that contribute towards underwriters' information production, i.e., the repeated game nature of interactions between underwriters and potential investors, also contribute to agency-type problems. A number of papers have examined whether underwriter – investor relations, combined with underwriters' conflicts of interest, cause shares to be allocated in ways that are not beneficial to the issuing firm.

Ritter and Zhang (2007), Reuter (2006), and Goldstein, Irvine, and Puckett (2011) examine whether investors receive more allocations of underpriced IPOs if they have more direct relations to the underwriter. Reuter (2006) finds a positive relation between the commissions that a mutual fund family paid to an investment bank and the fund's holdings of IPOs that were underwritten by that same bank. Moreover, this relation is concentrated among issues that had nonnegative first day returns. His findings are consistent with banks using IPO allocations as a way to reward investors that provide benefits to the bank. Ritter and Zhang (2007) focus on funds that are directly affiliated with the underwriter, and they find that such funds are more likely to be allocated shares of hot IPOs, thus boosting their performance. Using Abel-Noser data that contains detailed information regarding commissions received by lead underwriters, Goldstein, Irvine, and Puckett (2011) find a similar relation between the commissions that investors pay and the allocations of hot IPOs that they can expect to receive. Specifically, they conclude that institutions increase commissions through round-trip stock trades, higher average commissions per share, and the payment of unusually high commissions on some trades. This

practice is most common for non-regular investors; underwriters' concern for their long-term client relationships limits the practice.

Nimalendran, Ritter, Zhang (2007) devise a clever way to examine the extent of the allocations for commissions strategy. They posit that if institutional investors are churning shares as a way to generate commissions and increase allocations of hot IPOs, then we should observe a spike in the trading volume of the most liquid stocks. Consistent with this conjecture, they find that the trading volume of the 50 most liquid stocks in the market is 3 – 4% higher in the six days preceding a hot IPO.

On the whole these papers present strong prima-facie evidence suggesting that allocations are strongly motivated by favoritism, whereby investment banks reward good clients by giving them underpriced IPO, and/or by clients that increase banks' revenue through inflated trading commissions in return for receiving underpriced IPOs. This may be an optimal decision by investment banks and by their institutional investors. It is less clear why issuing firms, in competitive markets, agree to this. Further, it suggests that what many models describe as informed investors, may not actually provide information about the IPO firm but rather receive the IPO shares as part of a quid-pro-quo.

Liu and Ritter (2010) focus on side payments to executives through a practice known as spinning. Spinning refers to the investment bank's practice of allocating underpriced shares of IPOs to executives of other companies, where there is an implicit understanding that these allocations are in exchange for the executives directing future underwriting business to the bank. This practice is not legal. Liu and Ritter (2010) examine a sample of 56 companies in which top executives received allocations of other firms' hot IPOs. They hypothesize and find support for the hypothesis that these executives will bargain less aggressively for the highest possible offer

price in their own company's IPO: when these 56 companies went public, they had 23% higher underpricing than other companies. Moreover, these 56 companies were substantially less likely to switch underwriters for follow-on offerings.

In addition to spinning, laddering represents another practice for which underwriters received much criticism (and which violates SEC regulations related to market manipulation), in particular during the internet bubble period of the late 1990s through 2000. Laddering refers to the requirement that investors purchase additional shares in the aftermarket, as a precondition for receiving allocations in the IPO. Hao (2007) models the effect of laddering, specifically the ways in which the increased demand in the aftermarket contribute to higher aftermarket prices, and Griffin, Harris, and Topaloglu (2007) find empirical evidence consistent with the practice during their 1997 – 2002 sample period.

Survey evidence in Brau and Fawcett (2006) confirms that issuers perceive these agency-type issues to be important. Forty-two percent of CFO respondents believe that underwriters strive to underprice IPOs in order to curry favor with institutional investors. In comparison, Benveniste and Spindt's model receives only minimal support from survey respondents: only 10.25% of CFO respondents believe that underpricing compensates investors for truthfully revealing the price that they are willing to pay. However, respondents overwhelmingly suggest that underpricing serves purposes other than just side payments to underwriters: nearly 60% of respondents believe it compensates investors for taking the risk of the IPO, and over 40% believe it increases the post-issue trading volume of the stock and/or contributes to a wide base of owners.

Importantly, most of the findings suggesting that institutional investors receive higher allocation in exchange for information production / collection (which was presented in the

previous subsection) would also be consistent with the agency-related motives described here. Consider the finding that institutions tend to receive larger allocations. Does this reflect a reward to institutions for sharing value-relevant information with underwriters, or does it reflect a quid pro quo arrangement where the bank is rewarding its best clients? In a similar vein, does the partial adjustment phenomenon represent the mechanism that enables underwriters to successfully solicit information from informed investors, or does it represent the underwriter simply allocating more underpriced shares to their favorite costumers by only partially adjusting the price to what they learn during the roadshow? This is an immensely important issue, and one that we hope future research will be able to address directly.

### *4.5 Bookbuilding versus auctions*

By definition, underwriters' ability to manage investors' information acquisition by controlling allocations is unique to bookbuilding. As highlighted by Sherman (2005), under auctions the number of participating investors and their information production are uncertain and beyond the control of underwriters. Rational investors will only acquire information and place a bid if they expect to recover their information production costs, i.e., if they expect the shares to be sufficiently underpriced. However, if the auction mechanism is set such that the offer price equals the point where demand equals supply, then shares will not tend to be underpriced. Interestingly, as a way to mitigate such problems, W.R. Hambrecht (the underwriter that managed auction IPOs in the US) purposefully stated that the auctions would be 'dirty' auctions, in which the offer price is set below the clearing price.[16] Nevertheless, Sherman suggests that

[16] A recent paper by Schnitzlein, Shao and Sherman (2016) suggests a hybrid auction structure as an alternative way to overcome the problems of auctions (e.g., insufficient participation and price discovery), but still preserve their

auctions' susceptibility to these problems might explain the worldwide trend toward bookbuilding. We are still puzzled by this. It seems that issuers and regulators should push toward an auction system. It will create a more level playing field for investors, it will give investors the right incentives, and it will likely increase proceeds to the IPO firms. Since it reduces the role of bankers in the process, it might also reduce their fees.

While bookbuilding may offer advantages such as enhancing underwriters' ability to elicit information from investors, the discussion in the previous subsection highlights the costs that stem from underwriters' conflicts of interest. In light of this evidence, several papers have attempted to empirically examine the superiority of bookbuilding versus auctions. Sherman (2000) shows that bookbuilding is replacing auctions around the world, a piece of evidence that she interprets as being consistent with the superiority of bookbuilding. However, it is also possible that a small group (e.g., underwriters) derives strong benefits from the bookbuilding method, while a large disperse group (issuing companies) would benefit more if an auction method were prevalent. Consistent with this possibility, there exists a small number of underwriters who are both better informed and repeat players, while there exist a large number of individual companies each of which has little prior experience with public markets only has an IPO one time.

Derrien and Womack (2003) compare auctions, bookbuilding, and fixed price offers in the French market. They find that auctions are associated with less underpricing and less variance of underpricing, suggesting that auctions are on average preferable. However, it is admittedly challenging to ascertain the effects of the mechanism itself versus the type of firm

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advantages. Specifically, they consider a hybrid auction that includes a price-setting tranche open to institutions plus a non price-setting tranche for retail investors

choosing the mechanism. Nevertheless, subsequent studies by Lowry, Officer, and Schwert (2010) and Degeorge, Derrien and Womack (2010) reach similar conclusions in examinations of the small sample of firms that have gone public via auctions in the US market. Using detailed bid data, Degeorge et al are able to conduct an in-depth investigation of the extent to which these auctions suffer from either low investor participation or low information production. Notably, while prior literature suggests that these represent the biggest problems of auctions, Degeorge et al find little evidence to support these concerns. In a similar vein, an examination of the demand schedules of 27 Israeli IPOs by Kandel, Sarig and Wohl (1999) finds that demand is very elastic, suggesting substantial price discovery.

In examinations of Taiwanese IPOs, Chiang, Hirshleifer, Qian, and Sherman (2011) and Chiang, Qian and Sherman (2010) find that individuals' behavior in auctions contrasts dramatically with institutions' behavior. Individuals are more susceptible to behavioral biases, for example being more likely to bid in an IPO auction if they received high returns in past IPO auctions. Institutions are more likely to base their decision to bid on information costs: institutions enter an auction if the expected initial returns are sufficient to cover their costs of collecting information. These findings suggest that ensuring institutional participation in auctions is key.

The documented advantages of auctions increase the importance of the question raised at the beginning of this subsection: why is bookbuilding overtaking auctions as the dominant mechanism of bringing companies public. Kutsuna and Smith (2004) show that after Japan's 1997 introduction of bookbuilding as an alternative to hybrid auctions, all issuers in Japan began to choose bookbuilding. They conclude that net benefits of auctions versus bookbuilding vary by firm type. For the average firm, auctions result in smaller issuance costs. However, the

authors also find some evidence that small, high uncertainty firms, which are most susceptible to Myers and Majluf – type lemons problems and which would thus glean the highest benefits from the certification of an underwriter, avoided going public when auctions were the only available mechanism. As noted by the authors, results regarding this disadvantage of auctions are suggestive rather than conclusive, as they are unable to rule out the influence of hot markets that caused smaller companies to go public in many countries around the world during this late-1990s time period (which represents the time period of the bookbuilding sample). Degeorge, Derrien and Womack (2007) posit that the marketing behind bookbuilding issues explains the fact that this mechanism has grown in growing popularity, despite the lower costs and potentially greater pricing accuracy of the auction mechanism. Further, the fact that with only a few exceptions (see the Google IPO) most of the largest investment banks refuse to take part in any IPO unless it uses book building represents a significant reason for the lack of popularity of the auction method.

How IPOs are allocated to investors is an immensely important aspect of the IPO process for more than one reason. Clearly, bookbuilding - the most dominant method and arguably de facto the only method - does not treat all investors in an equal and fair manner. The adverse selection it creates for uninformed investors may be a reason that companies have to leave so much money on the table in the IPO process (Rock 1986). It gives an unfair advantage to institutions, especially to those institutions that have close contact with investment banks and that generate significant trading commissions for the banks. Bookbuilding also gave rise to laddering, which may artificially inflate IPO prices and at least in the short term cause a deviation of market prices from true prices even after the IPO; these effects are again to the

detriment of uninformed (mainly individual) investors. In sum, bookbuilding seems to distort prices both at the time of the IPO and during the first months of trading.

What then can be the justification for bookbuilding? Investment bankers argue that it helps them put the shares in the "right hands", meaning allocating shares to those investors who will not flip the shares. But this is clearly not the case as it is institutional investors who do most of the flipping. It is also argued that those institutions who get preferential treatment are also those who buy the cold IPOs, and thus on average make less profits than perceived. The jury is still out on the empirical validity of this argument. But even if true, we are not convinced that this cross subsidy is desirable or efficient. Finally, Benveniste et al (1989) and several follow up papers suggest that this method is optimal because this allocation method encourages institutions to gather information and reveal their private information about the upcoming IPO, resulting in a more efficient process. Maybe. Clearly, investment banks are better off with this allocation mechanism. The fact that auction type allocation mechanisms are not more popular is puzzling.

From an empirical perspective, is it clear that the lack of data on allocations (with only a few exceptions) makes it difficult to draw definitive conclusions. In our opinion it is in the best interests of the SEC and other regulatory bodies to make such data available to researchers so that the public and regulators will have a better understanding of how shares are allocated in practice and of the associated costs and benefits. The fact that investment banks are so reluctant to reveal IPOs allocations may suggest that the current practices are not in the best interests of the investing public. This is exactly the point where regulators should step in. Clearly, this is another area where more research can be immensely useful.

### *4.6 Agency costs within the issuing company*

While Section 4.4 focused on the effects of conflicts of interest within underwriter banks, a separate stream of literature has considered the effects of agency costs within the company itself on IPO pricing. Habib and Ljungqvist (2001) and Ljungqvist and Wilhelm (2003) note that agency-related issues potentially affect the ways in which managers of issuing firms influence offer prices. For example, an owner that plans to sell many shares in the IPO has strong incentives to limit underpricing, whereas a manager with limited ownership who plans to sell no shares in the IPO cares less about maximizing the offer price. Moreover, as highlighted by Habib and Ljunqvist, companies have the ability to limit underpricing by engaging in greater promotion, for example by hiring a top-rank advisors (e.g., investment banks, lawyers, auditors), by listing on certain exchanges (e.g., a high-tech company may choose to list on the US, rather than on its domestic exchange), and by choosing a firm-commitment offer rather than the lower-fee best efforts offer (where underwriters play much more active roles in firm-commitment offers). Consistent with general economics of agency, cases in which owners benefit more from limiting underpricing, e.g., in larger companies and in cases where the owner plans to sell more in the IPO, the company engages in greater promotion efforts. Ljungqvist and Wilhelm (2003) provide further evidence on the role of agency, finding for example that changes in ownership structure in companies going public in the dot.com era explained a substantial portion of the higher underpricing in these years (though Loughran and Ritter (2004), using a different measures of ownership, question this conclusion).

Lowry and Murphy (2007) similarly test the effects of agency on underpricing, but arrive at the opposite conclusion. They document that in one-third of IPOs, managers are granted options in which the exercise price is set equal to the IPO offer price. All else equal, such options give managers strong incentives to underprice the offer, as higher underpricing increases

the value of these options. However, controlling for pre-IPO ownership and estimating a wide range of empirical tests, they find no evidence of such a relation. This robust non-finding calls into question the effects of agency-related explanations on underpricing, at least in regards to the effects of agency costs of the manager-owner. In a subsequent paper, Chahine and Goergen (2011) estimate specifications where initial returns are regressed on CEO's gains from such options plus a number of interaction variables related to the governance structure of the firm. Including a broad set of such interaction terms, the authors find evidence that options issued at the IPO price do affect IPO underpricing within subsets of more weakly governed firms. Their findings highlight the importance of IPO governance, a topic to which we devote more attention in Section 8.

### *4.7 Information asymmetry between the issuing firm and the investment bank*

Baron (1982) develops a model in which banks are better informed about the value of the firm going public, than the firm itself. One way to think about this is that the bank can better estimate market demand for the issue, which is a critical determinant of price. Muscarella and Vetsuypens (1989) test this model by comparing the underpricing of banks who are managing their own IPOs (e.g., Morgan Stanley serving as underwriter on Morgan Stanley's IPOs) to the underpricing of other IPOs. They find that the underpricing of these self-underwritten bank IPOs is no different than the underpricing of other IPOs. While we agree that Baron's model implies that banks should be able to more accurately price their own IPOs, the issue of whether banks have incentives to price their IPOs closer to true value is debatable. Assuming that the bank benefits by underpricing IPOs, for example because they are easier to sell, it will be more

difficult to credibly argue to future clients that it is optimal to underprice their offerings if the bank did not underprice its own offering.

### *4.8 Prospect theory, investor inattention, and investor type*

Loughran and Ritter's (2002) finding (previously discussed in section 4.2) that public information is only partially incorporated into the offer price raises questions as to why this is an optimal outcome.[17] A complete explanation must consider the willingness of both underwriters and issuers for such "higher than necessary" underpricing. As discussed in sections 4.4 and 4.6, a number of papers have considered the effects of agency, within both the underwriter bank and the issuing firm. Loughran and Ritter (2002) propose a behavioral explanation, prospect theory: issuers care about the change in their wealth rather than the level. Consider a case in which the IPO is underpriced. The entrepreneur's wealth change around the time of the IPO represents the sum of two components: money lost due to underpricing (from shares sold at the offer price rather than the 'true' value, and also from the dilution effect of selling part of the firm for below market value), plus money gained because retained shares are valued at the higher market price. If the gain from the second component exceeds the loss from the first, then prospect theory argues that the issuer will be content. The fact that the entrepreneur could have been even wealthier if the IPO had been valued more highly is less relevant.

Purnanandam and Swaminathan (2004) conclude that despite the high underpricing of IPOs, the median IPO was significantly overvalued *at the offer price*, when valuations are computed based on industry peer price multiples. In addition to providing high first-day returns,

[17] While Loughran and Ritter (2002) emphasize that their finding of partial incorporation of public information into the offer price is inconsistent with Benveniste and Spindt, we note this finding is not necessarily inconsistent with Rock. However, one might argue that the magnitude of underpricing is difficult to explain within the framework of Rock's model, particularly certain times such as the internet bubble period.

these overvalued IPOs earn significantly lower abnormal returns over the long-run. The authors trace this price trajectory to optimistic growth forecasts around the time of the IPO, which are not realized. They conclude that investors pay insufficient attention to profitability around the time of the offer.

Finally, several papers consider the effects of investor clienteles on underpricing. For example, Derrien (2005) and Ljungqvist, Nanda and Singh (2006) conjecture that issuing firms and the institutional customers of investment banks benefit from the presence of sentiment investors. Building on this, Cook, Kieschnick, and Van Ness (2006) argue that the investment bank underwriter should promote IPOs to retail investors. While endogeneity concerns make it difficult to make definitive conclusions, their results suggest that investment banks do in fact benefit from such promotion efforts, for example through higher offer price revisions and higher offer price valuations relative to comparable firms. Consistent with these relations being driven by participation of retail investors, they find that average trade sizes are smaller in cases where promotional efforts were greater.

### *4.9 Other services provided by underwriters, in bookbuilding IPOs*

In addition to marketing and pricing the IPO, underwriters also frequently provide a number of services after the IPO, for example price support, market making activities, and analyst coverage. Starting with Michaely and Womack (1999) and Krigman, Shaw and Womack (2001), analyst coverage in particular has attracted substantial attention for its potential effects on underwriter selection, IPO pricing, and choice of bank for post-IPO transactions such as mergers and SEOs. Brau and Fawcett document that 83% of surveyed CFOs state the "quality

and reputation of the research department / analyst" to be an important determinant of underwriter selection.

A number of papers have examined the influence of analyst coverage in the IPO context. In this section, we highlight papers that focus on the relation between analyst coverage and pricing, and Section 5.3 reviews the literature on analyst coverage as it relates to IPOs more broadly.

Loughran and Ritter (2002) focus on the link between analyst coverage and underpricing; they posit the analyst lust hypothesis, under which companies are willing to accept large underpricing from prestigious underwriters because of the importance of coverage from influential analysts, which tend to be concentrated in these high-rank investment banks. Consistent with this argument, Cliff and Denis (2004) find that underpricing is higher among issues brought public by underwriters with an all-star analyst covering the issuer's industry. They further conclude that the relation is causal, rather than solely reflecting a scenario where managers underprice their offerings as a way to attract subsequent attention from both analysts and the media (a possibility suggested by Aggarwal, Krigman and Womack (2001)). Specifically, in addition to conducting 2SLS analyses that control for such endogeneity, Cliff and Dennis also find that companies are significantly more likely to switch lead underwriters between the IPO and SEO if the lead underwriter does not have a recommendation outstanding one year after the IPO. This latter finding regarding the influence of analyst coverage in underwriter switches is consistent with findings in Krigman, Shaw and Womack (2001). In fact, Krigman et al find that underpricing is not an important determinant of underwriter switches, suggesting that analyst coverage is the more important factor.

Liu and Ritter (2011) posit and find empirical support for the conjecture that VCs are particularly focused on analyst coverage, because they want a high price when shares are distributed to limited partners (frequently at the end of the lock-up period, 180 days after the IPO). While Liu and Ritter's reported results are based on OLS regressions and therefore may be sensitive to identification issues that make causal interpretations difficult, they find similar results using 2SLS regressions that control for endogeneity.

In addition to analyst coverage, price support is perceived to be an important service provided by underwriters. The objective of price support is to limit the extent to which the price falls below the offer price, and price support activities are generally concentrated within the first month after the offer. As explained by Ellis, Michaely, and O'Hara (2000) and Aggarwal (2000), underwriters can stabilize the aftermarket price of an IPO through the use of pure stabilizing bids, in which the underwriter purchases shares in the aftermarket, or through aftermarket short covering, in which the underwriter generally repurchases shares that were issued under the overallotment option.[18] The authors find that pure stabilizing bids (i.e., not supported by over-allotted options) are never used, and that aftermarket short covering is the most common. Ellis, Michaely and O'Hara further show that the lead always becomes market maker, and that the lead takes on substantial inventory, especially for IPOs with negative initial returns. Importantly, the overallotment option (described in more depth in section 3) substantially reduces this risk. Finally, in addition to price support being perceived as valuable by the issuing firm, Ellis et al find no evidence that these activities have to be subsidized by the profits from underwriting. Rather, they find that market making activities, of which the potential

[18] In addition, the underwriter may also employ penalty bids as a deterrence mechanism. Penalty bids refer to cases in which brokers whose clients sold IPO shares shortly after the IPO lose a portion of the commission that they made on the sale of the IPO shares.

for price support represents one component, is on average profitable for the lead underwriter, accounting for an average 23% of total IPO profits. Given the many changes in the markets over recent years, including for example increased participation by high frequency traders and lower bid-ask spreads, it is an empirical question whether trading activity continues to represent a significant source of profits for underwriters.

While price support is perceived by the firm as being beneficial, the economics of why a temporary manipulation of the price would provide long-run benefits are intriguing. Lewellen (2006) finds that stabilization appears to raise the equilibrium stock price, at least in the short run, as there is little evidence of declines in stock prices after the stabilization is withdrawn. However, it remains difficult to determine if the long-run price trajectory would have been different in the absence of both the overallotment option and price support. One possibility is that price support limits cascade-type effects (see, e.g., Welch, 1992) that potentially cause downward spirals in the stock price. To the extent that retail investors would be more susceptible to such phenomena, it is illustrative that Lewellen finds price support to be concentrated in issues with more retail participation.

### *4.10 Effects of the Lockup Period*

Most IPOs have lockup agreements that limit the periods during which insiders can sell shares. This is an agreement between the firm and the underwriter, not involving any of the regulatory bodies (see section 3 for more details). In any IPO with a lock-up agreement, insiders can sell shares in the IPO (in which case the sales must be disclosed in the prospectus) or at the expiration of the lockup period, but the lock-up agreement prevents sales in the interim period. The typical length of the lockup agreement is 180 days. Field and Hanka (2001) find that 80%

of IPOs from 1988 until 1997 had lockup periods of 180 days, and that lock up agreements tended to become more standard over their sample period: in the last year of their sample more than 90% of companies set the lockup period to 180 days. At the lockup expiration, when insiders first have the opportunity to sell their holdings, Field and Hanka (2001) document a -1.5% average return. They attribute this price drop to insider sales, and they find that it is more severe among companies backed by venture capital, which are themselves subject to the lockup agreements.

Brav and Gompers (2003) explore the potential role of the IPO lockup agreements. They test three hypotheses for the use of lockup agreements. First, a lock-up agreement may represent a signal of company quality: insiders (who are almost surely undiversified) will only agree to limits on selling if they are confident about the long-term value of the company. Second, the lock-up agreement may represent a commitment device to discipline the management, i.e., to commit them to continue to expend effort and to restrain from consuming excessive perquisites. Third, the lock-up agreement may represent a source of additional rent for the underwriter: the underwriter has the option to release insiders from the lockup 'early'(i.e., prior to the expiration), and in such cases the insiders are only permitted to sell through an SEO or via a block trade through the lead underwriter. In either case, the underwriter would earn additional fees. Cross-sectional comparisons indicate longer lock up agreements among companies with higher levels of potential moral hazard, suggesting they would be more susceptible to the commitment problems highlighted in hypothesis two. In contrast, the authors find no evidence that insiders of higher quality firms 'signal' their quality through longer lockup periods, as the signaling hypothesis would predict. Finally, Brav and Gompers also find that insiders are more likely to

be released early from these lockup agreements among companies with higher post-IPO returns, that were backed by VCs, and that were brought public by higher ranked underwriters.

### *4.11 Other theories of underpricing*

#### *4.11.1 How probability of issue withdrawal affects pricing*

In a samples of IPOs between 1985 and 2000, both Dunbar and Foerster (2008) and Edelen and Kadlec (2005) document that approximately 20% of IPOs that are initially filed are withdrawn. Using SDC data we examine the rate of withdrawals for a more recent period. Edelen and Kadlec (2005) and Busaba, Benveniste, and Guo (2001) posit that issuers (possibly together with their investment banks) factor the likelihood of being forced to withdraw the issue into their pricing of the issue. Edelen and Kadlec argue that any issuer that files to go public prefers public ownership to private ownership, but that this revealed preference must be conditional on the valuation under public ownership. If the issuer's utility from going public at the expected public valuation is large, then the issuer will price the deal conservatively to prevent withdrawal. Alternatively, if the issuer's utility is small, then the issuer will price the deal more aggressively because of a greater indifference between going public versus withdrawing and staying private.

Edelen and Kadlec note that a key implication of their model is that there should be no asymmetry in the extent to which positive versus negative market returns are incorporated into the offer price: following an increase in market returns, issuers should have a larger surplus from going public and thus price conservatively, i.e., incorporate only a portion of the positive information into price and thus accepting a lower price than might be possible. In contrast, following a decrease in market returns, issuers should price aggressively by incorporating only a

portion of the negative information into price and thus pushing for a higher price than would be achieved by incorporating 100% of this negative information. They argue that the asymmetry in prior literature is due to a truncation bias, which is driven by the fact that issues that would have been priced lower in response to low market returns are instead withdrawn. Empirical results that control for the sample selection resulting from withdrawn issues provide support.

In a similar vein, Busaba et al (2001) posit that underpricing is lower when investors perceive a greater likelihood that an issuer will withdraw the issue. Issuers with access to alternative sources of financing (proxied by debt ratio), with less uncertainty about company value (as proxied by level of revenues), and without venture backing have higher probabilities of withdrawal. Viewing this from the perspective of the company, a company that is more likely to withdraw, for example because it has access to more alternative forms of financing, is less willing to accept high underpricing in order to become publicly listed. Thus, we observe a negative relation between likelihood of withdrawal and underpricing.

#### *4.11.2 Lawsuit Avoidance*

Tinic (1988) represents a model that is based on a combination of both information asymmetry and various institutional factors. In particular, companies in the United States face a risk of class action, Section 11 lawsuits, and the details of damage calculations cause underpricing to provide a form of insurance against this risk. Specifically, if a company is sued for violations related to its securities offering (i.e., sued under Section 11 of the Securities Act of 1933), damages to investors are calculated as the difference between the price at which they purchased the issue and the lower of the offer price or the price at the end of the first day of trading. To provide an example, suppose an investor purchased a share on the day it went public,

where the company went public at $10 per share and closed at the end of the first day at $13. One year later, the company is sued for disclosing insufficient information in its prospectus, and at this time the stock is trading at $8. While in a typical lawsuit, the damages would be based on the difference between $13 and $8, in the case of Section 11 lawsuits related to securities offerings, the damages are based on the difference between $10 and $8. The lower potential damages have two effects: they decrease the cost in the event of a lawsuit, and they effectively lower the probability that a lawsuit is filed.

Lowry and Shu (2002) find support for Tinic's model in a sample of US IPOs. Using a 2SLS framework to address the endogeneity, they examine both the effects of litigation risk on initial returns, and the effects of underpricing on the probability of being sued. Companies with higher litigation risk underprice their offerings more as a form of insurance, and higher underpricing serves as a deterrent against lawsuits.

Hanley and Hoberg (2012) find that companies employ both underpricing and disclosure to protect themselves against litigation risk. They note that legal penalties are based on both alleged damages and alleged insufficient disclosure in the prospectus, suggesting they can protect themselves by either underpricing, as suggested by Tinic, or by increasing their level of disclosure. They argue that companies with large revisions in price (between the midpoint of the filing range and the offer price) but small changes in the text of the prospectus are particularly likely to have a material omission in the prospectus: some new information caused a change from the expected to the actual offer price, but this new information was not reflected in the prospectus. They find that these companies with a higher likelihood of poor disclosure tend to underprice their offerings by a greater amount. Based on these findings, they conclude that companies tend to employ either high quality disclosure or underpricing as a deterrent against

lawsuits. While intuitively plausible, it is important to note that many of the factors contributing to changes in the offer price and to underpricing are not incorporated in the prospectus, for example estimates of future growth, indications of interest from institutional investors, and underwriters' revisions to marketwide demand. Importantly, SEC demands for added disclosure, as communicated through SEC comment letters, drive many of the revisions to the prospectus.

Litigation continues to have a substantial effect on companies. Approximately 5 to 8% of IPOs are sued under Section 11 (depending on the sample period), and a greater number are sued if we include Section 10B-5 lawsuits as well.[19] Moreover, these lawsuits tend to be concentrated among larger companies, where expected damages are higher, suggesting that the probability of being sued will be much higher within certain subsamples. These lawsuits are costly both to companies and to underwriters, who are frequently named as co-defendants.

### *4.11.3 Other institutional factors*

The IPO market is affected by many institutional factors, as explained in Section 3. One of the factors that has received attention in the literature is limits to short selling, as originally proposed by Miller (1977). Miller notes that the heterogeneity of investors' valuations is particularly high for IPO firms, however short sale constraints in early trading limit the extent to which the negative opinions are factored into market prices. These limits to short sales are a function of few shares available to loan, for example because many pre-IPO investors are prevented from selling until after the expiration of the lock-up.

[19] Lowry and Shu find that 8% of IPOs between 1988 and 1995 are sued under Section 11; Hanley and Hoberg (2012) find that 5% of IPOs between 1997 and 2005 are sued under Section 11 and 10% under any form of class action lawsuit. In a sample of 2005 – 2013 IPOs examined by the authors of this review, 6% are sued under Section 11.

Consistent with Miller, Ljungqvist, Nanda, and Singh (2006) develop a model in which post-IPO short sales constraints can explain both the positive initial returns and long-run underperformance. Specifically, because issuers know that sentiment investors will bid up prices in the after-market and the opinions of pessimistic investors will be under-represented, they are able to price the IPO higher than they otherwise would. Institutional investors purchase the over-valued IPO shares because they know they can re-sell them to sentiment investors at even higher prices, resulting in high initial returns. Over time, as short-sales constraints relax, the negative information gets incorporated into prices and the issues underperform. As noted by the authors, this model is based on an assumption that IPOs underperform over the long-run, a premise for which the empirical literature provides mixed evidence and which is reviewed in depth in Section 6.

Ofek and Richardson (2003) focus more narrowly on the internet bubble period, but similarly conclude that stock price patterns on IPOs in this sector are consistent with Miller. Specifically, they document: higher short interest and higher borrowing costs for this set of stocks (consistent with short sale restrictions), heterogeneity in investors that would cause variation over time in the identity of the marginal investor (meaning the most optimistic investors change over time thereby contributing to continually increasing prices), and lock-up expirations that both substantially loosen short-sales constraints that are followed by significantly negative abnormal returns.

In contrast, Edwards and Hanley (2010) obtain actual data on short selling transactions, and they show that short selling occurs simultaneously with the opening day of trading in 99.5% of IPOs in their 2005 – 2006 sample. Moreover, by the fifth day of trading, the ratio of short selling to volume is only slightly lower than that for a sample of mature firms as documented by

Diether, Lee, and Werner (2009). In contrast to the predictions of Miller (1977), Edward and Hanley find that short selling is positively correlated with underpricing. This general availability of short selling in IPOs is consistent with findings of Geczy, Musto and Reed (2002), who find that shorting costs among those IPOs that are available to short are not substantial, averaging 44 basis points per year. However, as highlighted by Edwards and Hanley, shorting costs are unlikely to be equal across all firms, potentially being especially high among firms with low institutional investment (see, e.g., D'Avolio (2002)).

Patatoukas, Sloan and Wang (2016) focus on the cross-sectional differences in shorting constraints across IPO firms, and find substantial evidence that these constraints contribute to both underpricing and long-run returns. They hypothesize that firms with higher information asymmetry, with more divergent investor opinions, and with fewer shares available to trade (i.e., fewer shares issued in IPO and thus not subject to lock-up agreements) will have higher shorting costs. Consistent with predictions, they find that such firms have higher lending fees, higher initial returns, and more negative returns around lockup expirations. In sum, while most IPO firms are available to short after the offering, there are still substantial differences between firms, and these differences appear related to pricing patterns.

#### *4.11.4 Is underpricing a form of advertising?*

In their 2002 review paper of IPO underpricing, Ritter and Welch (2002) ask: "On theoretical grounds, however, it is unclear why underpricing is a more efficient signal than, say, … advertising". Chemmanur and Yan (2009) examine this directly. They hypothesize that firms will choose a higher level of product market advertising when they are planning to issue new equity, and that product market advertising and initial returns represent substitutes. Empirical

results, which are based on the subset of IPOs with positive advertising expenditures, provide strong support for their predictions. For example, advertising expenditures are significantly higher in the years of an equity offering, a finding that holds for both IPOs and SEOs. Second, in both OLS regressions and SUR regressions that control for endogeneity, the magnitude of underpricing is significantly lower when a firm expends more on advertising. To the extent that underpricing is a more efficient form of advertising to consumers than to businesses, we note that these relations should be stronger among business-to-consumer companies than among business-to-business companies. The authors do not examine such differences.

In a related vein, Demers and Lewellen (2003) also find that product market advertising is related to various dynamics of the IPO. They provide evidence consistent with the marketing benefits of underpricing: greater underpricing of internet firms is associated with a post-IPO increase in website traffic.

#### *4.11.5 The signaling hypothesis and information cascades*

Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) propose signaling models of underpricing, wherein high quality firms strive to distinguish themselves from low quality firms by incurring a cost, where the cost is underpricing of the IPO. Low quality firms cannot afford to incur this cost, and hence investors know that an underpriced IPO must represent a high quality firm. In general, this class of models has received little empirical support.

Welch (1992) proposes an information cascade model of IPOs, in which the order in which investors are approached about purchasing the issue affects the ultimate proceeds raised. The general intuition is that each investor has a private signal about firm value, and attempts to

infer the private signals of previous investors from their decision of whether to purchase the issue. Thus, the second investor makes a decision to purchase based on his private signal and the observed action of the first investor. The second investor is more likely to purchase if the first investor purchased. Each subsequent investor can observe the decisions of a greater number of prior investors, and thus puts less weight on his own signal. In this way, if the early investors view the offering favorably, the issue is more likely to succeed. Knowing about this cascades model, an issuer has an incentive to underprice the issue to increase the probability that early investors view the offering favorably. Amihud, Hauser and Kirsh (2003) find support for Welch's cascades model using a sample of Israeli data, where they are able to observe investors' subscriptions. Specifically, they find that investors tend to subscribe heavily to new issues, or to largely refrain, consistent with herding.

As this review chapter primarily concentrates on papers published since 2000, we refer the reader to other sources such as the excellent review by Ritter and Welch (2002) for a more detailed discussion of these important issues.

### *4.12 Is the underwriting market competitive?*

The ways in which one thinks about the underwriter's role is related to questions regarding the competitiveness of the underwriting market. Chen and Ritter (2000) document a striking clustering of spreads at 7%. Based on both the lower average spreads in other countries and the lack of a negative relation between spreads and proceeds across a wide range of issue sizes, they conclude that spreads for deals about $30 million are above competitive levels. We extend the sample and examine the underwriting spread for a long time period. While spreads today continue to have a substantial clustering at 7% (see Figure 7), investment banks claim that

underwriting IPOs is a loss-leader rather than a highly profitable activity. This seems surprising, given average IPO proceeds of approximately $111 million (in constant 2015 dollars, see Table 1), implying fees of around $7.8 million (calculated at 7%). Under an assumption that an IPO requires 3 months work of three associates, one vice-president and ½ of a managing director, being a underwriter would not seem like a loss leader. However, the lack of cost data and the ambiguity related to how costs should be allocated even if one had detailed data make this a difficult question to answer empirically.

Torstila (2003) and Hansen (2001) question the conclusion that the 7% clustering necessarily reflects collusion. Torstila finds that spreads cluster in many IPO markets around the world, and that many countries have greater clustering than the US. However, he notes that the level at which most other countries' spreads cluster is lower than that in the US. Hansen concludes that 7% represents efficient contracting rather than implicit collusion. He argues that underwriters compete on other dimensions, for example marketing and placement of the issue, and analyst coverage.

In sum, a common theme throughout much of this literature relates to the extent to which the underwriting market is competitive. The concentration of spreads and the large underpricing seem at odds with a competitive market, yet the large number of underwriters is strongly inconsistent with a monopolistic industry. Hoberg (2007) and Liu and Ritter (2010) suggest reasons for these apparent contradictions.

Hoberg (2007) finds strong evidence of underwriter persistence, where some underwriters tend to persistently underprice IPOs by substantially greater magnitudes than other underwriters. If all underwriters provide a similar service, one would expect competitive forces to diminish these differences over time. However, Hoberg concludes that underpricing is

actually a proxy for underwriter skill, with the higher quality underwriters underpricing offerings by a greater amount. To the extent that underwriters can exchange underpriced shares for other services, such as discussed above, the higher underpricing potentially substitutes for higher fees than would otherwise be observed. We note that the conclusions of this paper are all based on underpricing being positively related to underwriter rank, however as was discussed in depth in section 4.1 this is debatable.

Consistent with underwriters differing in important ways, Liu and Ritter (2010) argue that the underwriting market can best be modeled as a series of local oligopolies. While there are a large number of underwriters, they are not all competing directly against each other. A limited number of underwriters are positioned to best provide the services demanded by a particular company. For example, a large company backed by a top tier VC will focus on highly ranked investment banks with an all-star analyst in their industry, as potential underwriters for their IPO. In contrast, smaller, regionally-focused companies may be more likely to select among the set of investment banks with operations focused within their geographic region.

## 5. Role of other intermediaries: VC, Banks, Institutions, and Analysts.

In addition to the underwriter, there are several other financial intermediaries involved with the IPO firm, before, during, and in the months following the offering. During the pre-IPO period, institutions such as VCs and banks often provide both an advisory role and also certification for company value. After the offering, financial institutions such as investment banks potentially influence company performance, for example through analysts' recommendations and market making activity. The role of these intermediaries does not end at the IPO, with VCs typically continuing to holding shares after the IPO and banks frequently providing additional loans. We also review here the literature discussing the actions of the VC and other stakeholders at the end of the lock-up period, when insiders can start selling their shares freely.

### *5.1 Venture Capital Firms*

A typical startup company goes through several rounds of financing before its potential IPO. In the initial round of financing a company attracts "seed capital", generally from individual investors. These investors range from family and friends to wealthy individuals commonly referred to as angel investors. Companies that successfully develop past the initial stage may subsequently attempt to attract financing from a venture capitalist (VC). VCs provide a screening role, a monitoring role, and an advising role. The screening role refers to the VC's decision of which companies to fund, among the hundreds or even thousands of business plans it receives, whereas the monitoring and advising refer to the active influence of VCs, for example in terms of establishing connections to suppliers and customers, setting up governance structures, and regularly visiting the company and communicating with management. Sorenson (2007)

finds that at least two-thirds of the higher valuation of VC-backed companies stems from VCs' active influence on companies.

Prior to the IPO, a VC typically advises a company on its business and financial strategy, helps it to establish a governance structure (Baker and Gompers (2003) and Hochberg (2012)), and assists it in raising additional funds. The VC is generally closely involved with the company until the company successfully exits (where exit is defined as going public or being acquired) or until the investment is written off (a scenario that is commonly referred to as joining the living dead). Among companies that successfully go public, the VC holds shares until at least the end of the lock-up period but frequently much longer (see, e.g., Gompers and Lerner, 1998; Field and Hanka, 2001; Field and Sheehan, 2004). Bernstein, Giroud, and Townsend (2016) show that a higher level of VC engagement with the company increases both the company's innovation and its likelihood of successful exit, and Brav and Gompers (1997) show that IPOs backed by venture capital earn significantly higher returns over the three to five years after the IPO, compared to their non-venture backed counterparts.[20]

Our analysis reveals that among IPOs between 1972 and 2015, 37% were backed by venture capital. As shown in Table 4, venture capital backing is more common among younger companies and among companies in technology industries. The VC's role in screening, monitoring, and advising companies should decrease the level of information asymmetry surrounding the firm. Using data from the 1970s and 1980s Megginson and Weiss (1991) conclude that VC backing decreases first day returns, which is consistent with this prediction. However, in more recent periods VC-backed IPOs have tended to have higher initial returns, for example as shown in Figure 6. Lee and Wahal (2004) compare underpricing in VC-backed IPO

[20] The difference in post-IPO returns between venture- and nonventure-backed IPOs is only significant using equally weighted returns.

versus non-VC IPOs matched on size, industry, location, book value, underwriter rank and revenue, and find underpricing to be 5-10% higher among the VC-backed sample, with the difference being more pronounced during the "bubble period". This positive relation between VC backing and initial returns may be arttributed to endogeneity: companies backed by venture capital tend to belong to riskier industries and to be more difficult to value, suggesting that the coefficient on VC backing picks up these characteristics rather than the causal effects of VC backing on information asymmetry. In addition to benefits related to lower underpricing, Krishnan, Ivanov, Masulis and Singh (2011) suggest that higher ranked VCs contribute to better post-IPO long-run performance, an effect that they attribute to greater post-IPO involvement of higher ranked VCs. The true causal effects of VC backing on underpricing remain unclear.

In addition to the potential certification effects of VC backing, venture capitalists may also influence initial returns through a grandstanding effect. As posited by Gompers (1996), grandstanding refers to the incentives of younger VCs to take companies public earlier, as a way to demonstrate their ability to the market. The ability to take a company successfully through the IPO process is critical to a VC's reputation, specifically to its ability to raise further capital and to attract high-quality companies. Thus, the VC is willing to incur the costs of bringing a company public earlier than would otherwise be optimal. From the perspective of the company, which is typically younger and thus has higher information asymmetry, one of the costs of such grandstanding is higher underpricing. Consistent with grandstanding, Gompers finds that IPO firms backed by younger venture capital firms are on average 4.6 years old at the time of the IPO, compared to an average age of 6.6 years among companies backed by more mature VC firms. In terms of initial returns, IPOs backed by younger VC firms have average underpricing of 13.6%, compared to an average 7.3% among companies backed by more mature venture capital

firms. Given the changes in the types of firms going public, the changes in the VC industry, and also the changes in the association between VC-backing and underpricing, it would be valuable and interesting to re-examine this effect with more recent data.

A number of additional papers have further examined differences between IPOs backed by highly versus more lower ranked VCs. For example, companies backed by more highly ranked VCs are more likely to exit successfully, tend to have higher post-IPO valuations, and have higher average abnormal stock returns after the IPO (see, e.g., Sorenson (2007), Nahata (2008), Krishnan, Ivanov, Masulis, and Singh (2011))

Finally, Iliev and Lowry (2016) find that VCs financial commitment to the company often extends long after the IPO. While common wisdom has been that VCs strive to exit soon after the IPO (for example at the expiration of the lock-up period), Iliev and Lowry find that that in a nontrivial portion of cases VCs invest additional capital after the IPO. Specifically, in 15% of companies that were backed by venture capital firms prior to the IPO, a VC invests additional capital within the first five years after the IPO.[21] In approximately half of these cases the VC that funds the firm post-IPO is the same VC that also provided funding prior to the IPO. Their findings suggest that these post-IPO venture capital fundings occur predominantly in high information asymmetry companies with positive NPV projects – companies that Myers and Majluf (1984) characterize as frequently being unable to issue public equity at a viable price.

In sum, VCs perform a number of roles, which in aggregate have a positive effect. First, they screen companies prior to providing funding, meaning that the companies that receive venture backing are of above-average quality. Second, after providing funding, they play a very

[21] There exists considerable variation across VCs. For example, of all IPOs between 1995 and 2010, 3% of those backed by Kleiner Perkins prior to the IPO also received additional funding from Kleiner after the IPO, compared to an analogous rate of 12% for New Enterprise Associates.

active role within these companies, both in terms of monitoring management and in advising on matters ranging from employees, to operations, to governance. The extent of VC involvement and the quality of the VC positively affect company innovation, the likelihood of exit (via IPO or acquisition), and post-IPO long-run performance.

### *5.2 Banks and other lenders*

Interactions with other financial institutions can similarly provide certification of company value prior to the IPO. This issue was first examined by James and Weir (1990), who find that firms with bank loans prior to the IPO have significantly lower initial returns than their counterparts without pre-IPO loans. While this could reflect either differences in the types of firms obtaining bank loans (e.g., firms with bank loans may have more assets in place, lower information asymmetry) or the causal effects of the bank loan in lowering information asymmetry, they conclude that their evidence is suggestive of the latter explanation. More recently, Schenone (2004) examines this issue in more depth, in a manner that is better able to overcome the above endogneity issues. Specifically, she focuses on a sample of IPO firms, all of which had syndicated loans prior to the IPO, and she compares firms whose bank could have underwritten the IPO with those in which the bank did not have this capability. She hypothesizes that the effects of the bank loan in lowering information asymmetry should be greater if the bank providing the loan also served as underwriter. Results support this prediction, consistent with the existence of a previous relationship between the bank and underwriter lowering information asymmetry. Her results also indicate that companies with a pre-IPO *lending* relationship with a potential underwriter exhibit significantly lower underpricing than those with a pre-IPO *underwriting* history with a potential underwriter, which is consistent with

the lending relationship producing more information. (These findings may suggest that in cases where the investment bank has a prior banking relationship with the firm, the bank should be less concerned with soliciting information from outside investors (Benveniste and Spindt). The extent to which underwriters view these different sources of information as substitutes potentially provides a fruitful avenue for future research.)

Schenone's (2004) findings highlight the greater certification effects of banks that have served as lenders prior to the IPO, compared to banks that serve solely as underwriter. Other potential effects of such lenders, for example as a potential providers of post-IPO capital in cases that the firm becomes financially constrained, remain an avenue for future research. To the extent that such benefits exist, they would affect many firms. Gonzalez and James (2007) find that 67% of companies have a bank loan prior to the IPO; approximately 25% of IPO firms have a syndicated loans prior to going public.[22].

In recent years, "venture debt" has emerged as another source of capital for pre-IPO firms. Venture debt refers to loans provided to startup companies that typically have little or no positive cash flow but who have venture-capital-baking. The most active and dominant player in this market is the Silicon Valley Bank (SVB). In most cases, companies that take venture loans are not eligible for more conventional bank loans due to the lack of cash flow and/or fixed assets. Instead, innovation and intellectual property are frequently used as collateral. In term of its relevancy to IPO activity, venture debt has parallels to types of lending in terms of both its certification effects and its effects on pre-IPO capital structure. Another interesting aspect is the type of covenant venture lenders impose on companies that in many times have little earnings and at times even low or no revenues.

[22] Syndicated loans are made by a group of banks and are generally for substantially larger dollar amounts than non-syndicated loans.

The recency of the venture debt vehicle suggests that more information and more analysis can enhance our understanding of how debt might resolve both information asymmetry and agency issues and thereby have an impact on the IPO outcome.

### *5.3 Analyst Coverage*

Investment banks can influence IPO companies not only through the certification and advising channels prior to the IPO, but also via analysts' coverage after the offering. Analyst coverage is typically initiated at the end of the quiet period (see for example Michaely and Womack, 1999), where the quiet period refers to a time interval from prior to filing of the initial prospectus until its expiration same days after the IPO. Post IPO, the duration of the quiet period is 40 days, with the exception of companies that go public under the JOBS Act of 2012 who have a quiet period of 25 days. Prior to July 9, 2002, the duration of the quiet period was 25 days for all companies.[23]

The company and its insiders are prohibited from making any forward-looking statements during the quiet period, a limitation that forbids underwriter analysts from making earnings forecasts or stock recommendations during this time interval. The objective of the quiet period is to insure that potential investors rely on the IPO prospectus (which as discussed in Section 3 must be approved by the SEC as satisfying all relevant disclosure requirements) for all material information, that all investors are exposed to the same information, and that the stock is not hyped during this time period. While analysts from unaffiliated brokerage houses could issue

[23] The extension of the quiet period was part of the measure preceding the Global Settlement for managing underwriters. The length of the quiet period was changed by the NASD Rule 2711 http://finra.complinet.com/en/display/display.html?rbid=2403&element_id=3675.

recommendations during the quiet period, Michaely and Womack show that the lead underwriter typically issues the first recommendation at the end of the quiet period.

Several papers highlight the changes in analyst coverage of IPO firms over the past several decades. Over the 1990 – 1991 period, Michaely and Womack find that 51% of firms had analyst recommendations within the first year of the IPO, with approximately half of these being buy (or strong buy) recommendations by the underwriters and the other half being lower-level recommendations or recommendations by non-underwriters. Bradley, Jordan and Ritter (2003, 2008) find that the percent of cases with analyst initiation, the frequency of underwriter involvement, and the positiveness of the recommendations all increased over the 1996 – 2000 period. Across this period, 76% of IPOs had analyst coverage initiated *immediately* at the expiration of the quiet period (increasing from 58% to 95% over this five-year period), and 95% of recommendations were a buy or strong buy. Among 1999 – 2000 IPO, Bradley, Jordan, and Ritter (2008) find that the first recommendation comes from the lead or co-lead underwriter in 89% of cases.

The ways in which the market interprets the positive recommendations of affiliated analysts is a matter of some debate in the literature, potentially due to changes over time. The first paper to take an in-depth look at analyst coverage after IPOs, Michaely and Womack (1999), shows that managing underwriters tend to provide more positive analyst recommendations than other brokerage firms, but that these recommendations are more likely to be biased. Over the long-run, firms with buy recommendations from unaffiliated analysts tend to outperform firms with a similar recommendation from the lead underwriter. Michaely and Womack (1999) empirically show that conflicts of interest within the bank contribute to such a

bias. Specifically, analysts might strategically provide more positive recommendations to make the bank more attractive as a potential underwriter in future offerings.

In contrast to Michaely and Womack, Bradley et al (2003) find little difference in either the recommendations or the associated abnormal returns of the affiliated versus non-affiliated analysts. The market interprets these initiations of analyst coverage as positive news, regardless of the analyst providing the recommendation. Companies that receive the first analyst recommendation immediately upon expiration of the quiet period, experience a 4.1% abnormal return, compared to a 0.1% abnormal return among their counterparts with no coverage initiations.

James and Karceski (2006) attempt to shed further light on differences between affiliated versus nonaffiliated analysts through an investigation of both recommendations and target price estimates, where the latter shows more variation. Their results provide further evidence that analysts affiliated with the lead underwriter are more optimistic than other analysts. Similar to Michaely and Womack, they find that the differences between affiliated and non-affiliated analysts are concentrated within issues that performed poorly after the IPO, for example those with non-positive initial returns. However, while these 'booster shots' are presumably intended to bolster the price of the newly public firm, the authors find that the market discounts these affiliated recommendations.

The incentives of underwriter banks to provide positive recommendations are high. For example, Krigman, Shaw and Womack (2001) and Cliff and Denis (2004) show that companies are more prone to switch underwriters between the IPO and SEO if the bank did not provide extensive analyst coverage after the initial offering. Moreover, companies perceive these analyst recommendations as an important determinant in their selection of an underwriter. Dunbar

(2000) finds that changes in investment bank market share year-to-year are positively related to changes in the reputation of the bank's analysts, particularly within the set of highly ranked investment banks.

In a study that includes both debt and equity offerings and both IPOs and SEOs, Ljungqvist, Marston and Wilhelm (2006) argue that the effects of analysts are limited to whether a bank has an all-star analyst within the issuer's industry; banks do not win more underwriting business through inflated analyst recommendations.[24] Their findings highlight the importance of long-term relations between the bank and the firm, for example whether the bank has underwritten past bond, loan, or equity offerings or has an equity investment in the firm, as determinants of bank selection.

The strategic upward bias in analyst recommendations harms market efficiency, and it predominantly affects the small investors who rely more on the information provided. The former New York State Attorney General, Eliot Spitzer, investigated the analyst activity of the largest investment banks. The investigation found that most banks directed their analysts to issue only bullish recommendations. The Global Analyst Research Settlement (Global Settlement) of April 28, 2003 is an enforcement agreement that was reached as an outcome of this investigation. Ten investment banks (Bear Stearns, Credit Suisse First Boston, Deutsche Bank, Goldman Sachs, J.P. Morgan Chase, Lehman Brothers, Merrill Lynch, Morgan Stanley, Salomon Smith Barney, UBS Warburg) cumulatively paid $1.4 billion in fines under the Global Settlement. Also, banks were required to isolate their banking and analyst departments with so-called "Chinese Walls". For instance, analysts were no longer allowed to participate in the IPO roadshows. As noted earlier, the Global Settlement also increased the length of the quiet

[24] Ljungqvist, Marston and Wilhelm (2009), using a similar sample of IPOs, SEOs, and debt offerings, conclude that the selection of co-managers is positively related to analyst optimism.

period from 25 to 40 days and enforced the disclosure of historic analyst rankings, allowing investors a better relative perspective on how bullish the analyst really is.

Kadan, Madureira, Wang, and Zach (2009) explore the changes in analyst behavior after the Global Settlement. They find that sanctioned banks switched from a five category ranking to a ranking with only three categories: optimistic, neutral and pessimistic. Moreover, the frequency of optimistic recommendations significantly decreased after the Global Settlement. Their results suggest that following the Global Settlement there is no longer a significant difference in the recommendations of affiliated versus unaffiliated analysts. Consistent with the notion that recommendations were biased prior to the GS, they find that following the implementation of the new ranking system, market reactions to optimistic recommendation became stronger while reactions to negative and neutral recommendations became more negative. In sum, their results indicate that the Global Settlement had some success in alleviating of conflicts of interests within underwriter banks.

More recently, the JOBS Act has again allowed for changes in the role of analysts. The JOBS Act aimed to increase the net benefits of going public for IPO issuers with less than $1 billion in pre-IPO annual revenue, and one portion of the Act was to increase the involvement of research analysts. Specifically, analysts affiliated with the underwriter are allowed to attend pitch meetings, to attend due diligence sessions, and to interact with potential investors prior to the IPO. Importantly, the JOBS Act did not relax the restrictions on analyst compensation, which were put in place as part of the Global Settlement. Dambra, Field, Gustafson, and Pisciotta (2016) examine whether this involvement of affiliated analysts contributes to: (1) more accurate earnings forecasts, which would potentially benefit the company through the lower information asymmetry, or (2) more optimistically biased earnings, which would potentially help the bank

through increased banking or trading revenues. Analyses of firm abnormal returns and of trading volume support the importance of the latter factor. In sum, the pre-IPO involvement of the research analysts appears to benefit the bank rather than the firm.

### *5.4 Institutional Investors*

Going back to Rock (1986) and Benveniste and Spindt (1989) IPO underpricing theories have posited that institutional investors have an informational advantage and that as a result of this advantage they obtain greater allocations of underpriced shares. As discussed in Section 4, several papers have examined allocations to the IPO, as a way to better understand the ways in which the bookbuilding mechanism rewards institutional investors. In addition to these previously discussed studies, another stream of literature has examined institutions' behavior in the aftermarket, with a focus on the extent to which institutions play a supportive role for cold IPOs, the extent to which institutions' information advantage continues after the IPO, and the extent to which institutions profit from their allocations.

Underwriters who are trying to support the price of IPOs that received a cold shoulder by the market, (for example cases in which the underwriter engaged in price support to avoid a precipitous price drop after the IPO; see section 3 for a discussion), have an obvious preference that institutions hold on to their shares rather than quickly flip their shares. From the perspective of institutions, incentives are more nuanced. Looking at the P&L for any given IPO, institutions would prefer to quickly sell their shares if they believe its price is going to go down, in an effort to limit losses. However, since underwriters potentially link allocations of subsequent IPOs to such flipping behavior, institutions may optimally elect to hold 'cold' shares longer. Both Aggarwal (2003) and Chemmanur, Hu and Huang (2010) find evidence to support the latter

scenario. Using a sample of proprietary data on 193 IPOs managed by nine large investment banks over the May 1997 – June 1998 period, Aggarwal finds that approximately 15% of shares offered are flipped within the first two days, with flipping being higher among institutional investors and in hot IPOs. Using a combination of 13F data and proprietary transaction-level trading data from Abel/Noser Corporation to examine the trading of 419 large institutions across 909 IPOs between 1999 and 2004, Chemmanur, Huang and Hu (2010) find that underwriters reward those institutions that hold cold IPOs longer with higher allocations in subsequent underpriced IPOs. In addition to shedding insight on flipping behavior, an important conclusion from these findings is that flipping makes quarterly 13F holdings a very imperfect proxy for IPO allocations, a point that future researchers should bear in mind.

Field and Lowry (2009) investigate the relation between institutional holdings and post-IPO returns over longer intervals. Focusing on holdings at least six weeks after the offering (after the effects of price-support and flipping restrictions have wound down), they find that institutional ownership is significantly positively related to post-IPO performance. Institutions are significantly less likely to hold shares in those companies with especially poor post-IPO long-run performance. They conclude that institutions' superior performance, compared to that of individuals, stems from a superior ability to analyze the publicly available data. Institutions disproportionately invest in the types of firms that earn significantly higher abnormal returns, for example firms that are venture backed, were backed by higher-ranked underwriters, etc.

Chemmanur, Hu, and Huang (2010) similarly conclude that institutions have an informational advantage during the months after the IPO, but unlike Field and Lowry they conclude that private information contributes to this advantage. They further find that only the trades of institutions that participated directly in the IPO (i.e., who were allocated shares) are

predictive of subsequent returns, and they conclude that institutions' information advantage arises from participation in the IPO. However, the fact that participation in any IPO represents a choice makes it difficult to differentiate this interpretation from one driven by sample selection, where those institutions that choose to participate are those with incremental insight into firm value.

## 6. The long-run performance of IPOs

One of the substantial puzzles regarding IPOs is that, over many time periods, evidence suggests they are terrible investments. Starting with Ritter (1991) and Loughran and Ritter (1995), papers have documented that IPO firms underperform the market for the three and five years after the IPO. These studies generally measure returns starting with the aftermarket price at the end of the first day or the end of the first month, thus capturing returns to an investor who bought shares in the aftermarket (as opposed to being allocated shares at the IPO offer price). Loughran and Ritter document that over the five years following an IPO, the average firm earned just 5% per year. An investor would have had to purchase an outstanding 44% more money in a IPO firm, compared to in a non-issuing company of the same size, to have the same wealth five years later. This section first reviews the important issues related to post-IPO performance, and then presents statistics using updated samples.

Both Ritter (1991) and Loughran and Ritter (1995) conclude that their findings of IPO underperformance reflect investor behavioral biases that cause them to be overoptimistic during certain periods, combined with managers who can successfully time the market. Consistent with this conclusion, both papers find that the underperformance is greater for firms that issue during high volume months. Adding further weight to this conclusion, Baker and Wurgler (2000) find that the portion of total new issues that reflect equity (as opposed to debt) is negatively correlated with subsequent market returns.[25]

Systematic underperformance following capital raising would suggest that the markets are not allocating capital optimally, a conclusion that is obviously troubling. Perhaps not surprisingly, a variety of papers have posited other explanations. Much of this literature begins

[25] Pontiff and Woodgate (2008) subsequently show that this conclusion is robust to various issues related to the specification of abnormal returns, many of which are discussed in the remainder of this subsection.

with one point of broad agreement: absent any transactions costs or constraints, if markets are efficient then abnormal returns should not be predictable ex ante. To the extent that we agree on this statement (more on that later), this point leads to several questions: Is the finding of post-IPO underperformance driven by incorrect calculation of abnormal returns? Are there substantial transactions costs, for example related to shorting, that prevent negative information from being incorporated into price? Or finally, does this truly reflect evidence of market inefficiencies?

With regards to the calculation of abnormal returns, one must consider both the benchmarks to risk-adjust returns and the correct calculation of standard errors. Brav and Gompers (1997) document several key facts related to these issues. First, the underperformance of IPOs is restricted to small companies that were not backed by venture capital. Second, the underperformance of this group of firms is not an IPO effect: firms of similar size and book-to-market performed equally poorly. This second finding is consistent with the point originally made by Fama and French (1993) and later highlighted by both Mitchell and Stafford (2000) and Brav, Geczy, and Gompers (2000) that the three-factor model is unable to price small, low book-to-market firms. Notably, many IPO firms fit into this category. Interestingly, Fama and French (2004) find that delistings for poor performance are concentrated within this same group of small firms.

Brav and Gompers also point out that standard errors will tend to be understated if one does not account for the likely cross-correlation between IPO firms' returns. Because IPOs tend to cluster in calendar time and because similar types of firms tend to go public around the same time, cross-correlations are likely to be substantial. T-statistics that treat each firm as an individual observation are almost certainly overstated. Calendar time portfolios inherently

control for such cross-correlations, making them a strong candidate for measuring abnormal performance. Loughran and Ritter (2000) present a rebuttal to the use of the calendar time approach, arguing that it will be biased against finding any abnormal performance that would arise as a result of market timing (i.e., if managers can successfully time the market). First, because the calendar time approach equal-weights each month instead of each firm, it inherently gives lower weight to offerings that occur in high-volume months, which under the market timing hypothesis represent exactly those offerings for which one would predict the greatest underperformance. Second, the use of calendar time portfolios is inherently a value-weighted approach. To the extent that behavioral biases are more likely to affect the prices of small firms (due to wider bid-ask spreads and lower institutional participation), the calendar time approach again underweights the firms with the greatest expected underperformance. Notwithstanding these concerns, due in large part to the cross-correlation issues highlighted at the beginning of this paragraph, we note that the literature has moved toward calendar time portfolio returns as the better method of measuring abnormal performance.

Focusing on economic rather than measurement issues, Field and Lowry (2009) suggest that transactions costs related to shorting may contribute to observed underperformance. They show that post-IPO underperformance is limited to firms with the lowest levels of institutional ownership. If firms with low institutional ownership are costlier to short (see also Nagel (2005)), then any overvaluation that arises from the opinions of more optimistic investors may be more likely to persist, as the opinions of the more pessimistic investors fail to be incorporated into price.

One concern with this body of work relates to the relatively narrow time period over which most of these studies focus. Are the findings sample-specific? Gompers and Lerner

(2003) address this issue through the study of 3,661 IPOs from 1935 to 1972, prior to the founding of Nasdaq. Consistent with the conclusions of some of the aforementioned studies over more recent time periods, they find some evidence of negative performance when abnormal returns are calculated in event time, but no evidence of abnormal performance using a calendar-time analysis.

Using IPOs from 1973 to 2012, we calculate abnormal returns using several different metrics and over several different time periods. Panels A and B of Table 10 show buy-and-hold returns over three and five years following the IPO, respectively. We compare these to buy-and-hold returns (measured over the same intervals) across four benchmark portfolios: the equal-weighted index, the value-weighted index, size-matched portfolios, and size and book-to-market matched portfolios. Panels A – D of Table 11 show calendar time portfolio returns, similarly using 3-year and 5-year post IPO returns. We use a 4-factor model, and estimate monthly regressions where the portfolio each month consists of firms that have gone public within the past 36 months (Panels A and B) or 60 months (Panels C and D). To evaluate the extent to which weighting affects results, we estimate each of these on both an equal-weighted (Panels A and C) and value-weighted (Panels B and D) basis.

Results indicate that IPOs on average underperform equal weighted index benchmarks, and in some periods value weighted index benchmarks as well. Over the entire sample period, the wealth relatives based on the equal-weighted benchmark are 0.69 and 0.56 at the three- and five-year intervals, respectively. Thus, a person that invested $1 in every IPO (purchasing at the closing price on the first day of trading) would only earn 56 - 69% as much as a person that instead invested a dollar in the equal-weighted index at the time of each IPO. In comparison,

the underperformance relative to the value-weighted index is much less severe: investing in IPOs yields 84 - 88% as much as the value-weighted index.

The value-weighted index, by construction, places the most weight on companies that are far larger than the typical IPO firm. Interestingly, the benchmark returns of the size-matched portfolio, are between those of the equal- and value-weighted indices. When IPO performance is compared to firms of similar size the difference in long-run returns is very small, with the wealth relative over the three-year horizon equaling 0.93 across the entire sample period and varying between 0.84 and 1.39 across the subperiods (with similar statistics over the five-year horizon).

Including book-to-market as well as size in the benchmark yields a three-year wealth relative that is similar over the entire sample period, 0.95 for size and BM-matched vs. 0.93 for the size-only benchmark. However, there are meaningful differences within some of the subperiods, e.g., during the 1980s the wealth relative is 0.89 when using the size-matched benchmark but a much higher 0.98 using the size and BM matched benchmark. Results are generally similar using five-year post-IPO returns.

An important caveat with respect to buy-and-hold returns is that they can be extremely skewed. In addition, cross-correlations in returns across companies going public close in calendar time make it impossible to evaluate significance. Calendar time portfolios overcome both of these issues, and we turn to them next. For robustness and to better understand the true drivers of post-IPO performance, we estimate four variations of post-IPO calendar time portfolio regressions. We estimate these regressions over both three and five-year horizons, and we calculate the portfolio returns on both an equal-weighted and value-weighted basis. Specifically, the dependent variable equals either the equally-weighted average returns or the value-weighted average returns across all companies that have gone public within the past 36 (or

60) months. Across all these specifications, the intercept, commonly referred to as the alpha, represents a measure of abnormal performance. Results provide no evidence of significant over- or under-performance. Over all specifications and all sample periods (full sample and subsample periods), the alpha is never significant at conventional levels.

Together, these various specifications enable us to make several conclusions regarding post-IPO performance. First, IPO firms significantly underperform a broad equal-weighted market index, but perform similarly to size-matched firms. Second, there is some evidence that IPOs overperform in some sub-periods relative to size and book-to-market matched firms, but these buy-and-hold returns and associated wealth relatives can be highly skewed, thus prohibiting any conclusions regarding significance. Third, after controlling for cross-correlations between firms that go public close in calendar time via calendar time portfolio regressions, we find no evidence that IPOs over- or under-perform relatively to firms of similar size and book-to-market. In sum, to the extent that the four factor calendar time portfolio represents an appropriate method of evaluating post-IPO performance, we can conclude that IPOs perform similar to other firms with similar risk characteristics.

## 7. IPO cycles

As first documented by Ibbotson and Jaffe (1975) and Ibbotson, Sindelar and Ritter (1988, 1994) and as highlighted in Figures 1 and 2, the IPO market is characterized by dramatic fluctuations over time. Both the number of companies going public and average initial returns vary substantially, with the periods of highest initial returns being followed several months later by peaks in the number of IPOs. In addition, the figure also highlights the secular decrease in the number of IPOs starting in 2000 (which we discussed in previous sections). Cycles in the post-2000 period are more muted, with 'hot markets' being 'less hot', compared to the hot markets of the late-1990s or mid-1980s. Finally, there is some evidence of cycles in post-IPO outcomes as well. For example, looking at Figure 14 we see that the percent of firms delisting for poor performance was substantially higher among those issued during the hot markets of the mid-1980s and late 1990s. Fama and French (2004) document that whereas 17% of firms going public in 1973 delisted for poor performance within ten years, this increased to 44% of firms going public between 1980 and 1991. Figure 14 indicates that this percentage has been lower in more recent years.

What is the reason for these cycles and for the empirical regularities associated with them? Similar to examinations of other patterns in IPO markets, the literature has debated whether these fluctuations are driven by irrationalities (e.g., investor optimism) or whether they are consistent with efficient markets. Posited explanations in the literature include:

- Fluctuations in investor sentiment, which cause investors to overvalue equity and to overpay for newly public companies during some periods
- Fluctuations in demands for capital, for example as driven by variation in marcroeconomic conditions

- Fluctuations in market-wide information asymmetry, which affect the costs of issuing equity
- Variation in the real option of staying private
- Product-market effects

In an attempt to understand why so many companies go public during some periods, combined with so few during others, Lowry (2003) focuses on the first three of these potential explanations: demands for capital, investor sentiment, and information asymmetry. In a series of regressions of IPO volume on proxies for each of these factors, combined with analyses of post-IPO returns of companies going public during different periods, she finds strong support for the first two factors, combined with minimal support for the third. Consistent with more companies going public when economy-wide conditions are favorable and thus firms' demands for capital higher, the number of IPOs is significantly positively related to the future sales growth of all publicly traded firms and to the change in the number of new companies incorporating, a measure of new business creation.[26] Investor sentiment also plays an important role, as evidenced by the finding that IPO trading volume is negatively related to both the closed-end fund discount and to future market returns. In economic terms, she concludes that variation in investor sentiment has an effect two times larger than demand for capital.

Pastor and Veronesi (2005) come to a different conclusion regarding the effects of mispricing. They present a real options model of the decision to go public, where mispricing plays no role. Rather, the decision is a function of expected market returns, expected aggregate

[26] It is intriguing that the number of IPOs is positively related to future sales growth of publicly traded companies and future GDP growth, as shown by both Lowry (2003) and Gao, Ritter, and Zhao (2013), but negatively related to future market returns (as discussed in more detail below). This combination of findings is consistent with Pastor and Veronesi's model, which suggests that more companies tend to go public when growth opportunities have been priced into stocks; the realization of these growth opportunities is observed through subsequent sales and GDP growth.

profitability, and prior uncertainty. Variation in these factors causes variation in managers' decisions to exercise their options to go public. The result is cycles in IPO volume that are generated without any mispricing. In a similar vein, Benninga, Helmantel and Sarig (2005) also consider the decision to go public as a trade-off: managers lose private benefits of control, but gain capital to grow the firm as well as the ability to diversify. When expected future cash flows are higher, for example as a result of a positive economic shock, the net benefits of going public are more likely to be positive. Because firms' cash flows are cross-sectionally correlated, we observe cycles in IPO volume.[27] These models however, are unable to explain the significantly higher failure rate among firms who go public during hot markets.

Beyond the cycles in the number of companies going public, perhaps even more puzzling is the strong autocorrelation in initial returns, combined with the fact that the periods of highest initial returns are followed several months later by the periods of highest number of IPOs. This simple statistical pattern appears to raise an interesting issue: why would companies choose to go public when underpricing is particularly high? Several explanations have been posed, though many share certain common features. Lowry and Schwert (2002) conclude that the serial correlation in initial returns is entirely driven by two factors: changes in the types of firms that go public over time (with certain types of firms tending to be more underpriced than others, see, e.g., Rock (1986), Beatty and Ritter (1986)), and by information that becomes available during the registration period but is only partially incorporated into the offer price (with positive information learned during the filing period being associated with higher price updates and

[27] Chemmanur and He (2011) argue that product market effects can cause cycles in IPO markets to arise in the absence of either productivity shocks or investor sentiment. If the proceeds raised through an IPO enable a company to compete more aggressively, then a company may decide to go public as a means to gain market share. However, the fact that a competitor plans to go public potentially causes other firms in the industry to also go public, as a means to avoid losing market share.

higher initial returns, see, e.g., Benveniste and Spindt)). In sum, the answer that this paper provides to the apparent puzzle posed at the beginning of this paragraph "why would companies choose to go public when underpricing is particularly high" is that high recent underpricing does *not* mean that a company will be more underpriced; rather, it indicates that high information asymmetry companies have been going public and it suggests that the company will be able to raise more money than previously expected. As discussed below, subsequent studies that have investigated whether these hot markets represent periods when the market fundamentally overvalues these IPO firms (for example through examinations of post-IPO returns) reach different conclusions.

Another possible explanation for this relation is related to Purnanandam and Swaminathan's (2004) findings. They show that while IPOs are priced relative to their trading peers (e.g., industry comparables), they are priced in comparison to the left tale of the trading peers' distribution. Thus when the market is over-valued, we see a phenomena of high first day returns, as we documented above. Also when the market is over-valued more firms go public because they receive high valuations. Thus the positive association between IPO volume and large first day returns is not causal but rather due to the omitted over-valuation of all firms in the economy or industry, which causes more firm to go public.

The conclusion that economic shocks in conjunction with information spillovers generate many of the observed cycles in IPOs, including both the numbers of IPOs and average initial returns, has also been shown empirically by Benveniste, Ljungqvist, Wilhelm and Yu (2003) and theoretically by Alti (2005), who discuss the ways in which information learned by one company affects the decisions of subsequent companies to go public. Across this literature, there is a common consensus that at least a portion of cycles represent the effects of learning: if the first

company learns that the market values it more highly than expected, then subsequent companies are more likely to go public. This conclusion is consistent with practitioner accounts of one company 'testing the waters', and other companies waiting to observe how that offering will be received by the market.

Finally, several papers have focused on the role of the underwriter in generating the observed cycles. On the one hand, if more information is produced when many companies go public, then underwriters have incentives to encourage clustering in the volume of companies going public (see, e.g., Benveniste, Ljungqvist, Wilhelm and Yu (2003); He (2007)). Alternatively, if the underwriter has certain constraints in labor supply, then it may be less able to accurately value companies when the number of IPOs is extremely high (see, e.g., Khanna, Noe and Sonti (2007)). Finally, if underwriters have greater market power during periods when more companies are going public (for example if companies are all competing for coverage from the highest profile analysts), this would similarly contribute toward a positive relation between underpricing and the number of companies going public (see, e.g., Liu and Ritter (2011)). Boeh and Dunbar (2016) find evidence in support of this last theory.[28]

A common idea behind many of the above conclusions is that the type of firm going public varies over time. The 'efficient markets' explanation is that a technological innovation or economic shock causes certain firms to demand more capital to fund positive NPV projects, for example firms in certain industries or riskier firms whose prospects had previously been less certain. Alternatively, the 'investor sentiment' explanation is that lower quality firms will go public during hot markets, when the firms are able to raise equity at a price exceeding true value. Within the empirical literature, there is a lack of consensus on both the extent to which firm type

[28] Specifically, Boeh and Dunbar use the number of companies that register to go public after the IPO of focus, to avoid endogeneity issues. They find that this pipeline measure is positively related to underpricing.

varies over cycles and whether efficient markets versus investor sentiment explanations can better explain observed patterns. Our view is that both factors play significant roles. Macro-economic conditions that influence demand for capital almost certainly are important. However, beyond this, many patterns in the data suggest the influence of over-valuation: during hot markets, riskier firms are able to raise capital and first day returns are significantly higher, suggesting that investors view those firms' cost of capital lower than their underwriters and participating institutions. Finally, there is evidence that firms going public during hot market under-perform in absolute terms.

An alternative to examining firm characteristics directly is to focus on post-IPO performance. Yung, Colak and Wang (2008) find that companies going public in hot markets have both a higher *standard deviation* of post-IPO long-run abnormal returns (measured for example over the three to twelve months after the IPO) and are significantly more likely to have the extremely bad outcome of delisting for poor performance, as we also show in Figure 14. This evidence is consistent with greater dispersion in the types of companies going public in hot markets, including more lower quality firms. However, it doesn't directly address the question of whether hot market IPOs are on average more overpriced, as the authors do not compare *average* abnormal returns.[29]

Lowry, Officer and Schwert (2010) examine variation in firm type through a very different avenue. They note that Beatty and Ritter's (1986) extension of Rock's (1986) model

[29] Helwege and Liang (2004) examine variation in firm characteristics directly, over hot versus cold markets. They fail to find consistent evidence of hot market IPO firms being riskier, or more characteristic of young start-ups. For example, while hot market IPOs have lower operating income, they are similar to cold market IPOs in terms of firm age and industry-adjusted market-to-book ratios. It would be interesting to revisit this issue using more recent data, and perhaps data from around the globe.

predicts that higher information asymmetry companies will tend to have both a higher level of initial returns and a lower precision of pricing. In other words, to the extent that certain periods are characterized by higher information asymmetry companies, we would expect both the average level and the volatility of underpricing (measured as average initial returns, and as the cross-sectional standard deviation of initial returns, respectively, across all IPOs in a month) to be higher. Consistent with this conjecture, they find a strong positive correlation between these series, leading to the conclusion that a substantial portion of the cycles in initial returns is driven by variation in the information asymmetry of the firms going public, combined with underwriters' challenges in accurately valuing these types of firms.

The evidence in Lowry et al (2010) is important but does not address the extent to which changing investor sentiment (and firms' associated abilities to capture over-valuation) contributes to cycles in IPO volume. That is do firms going public in hot markets perform worse. While clearly important, we discuss this issue last because there is not a clear answer in the literature. Early papers such as Ritter (1991) and Loughran and Ritter (1995) conclude that hot market IPOs perform significantly worse in the long-term. In a cross-sectional regression of post-IPO three year raw returns on market returns over the same period, IPO volume and various controls, Ritter (1991) finds a significantly negative coefficient on IPO volume. Using Fama-MacBeth regressions of monthly stock returns on firm size, book-to-market, and an issue dummy equal to one if the firm had an IPO or SEO over the past five years (1970 – 1990 period), Loughran and Ritter (1995) conclude that firms going public in hot markets underperformed by

60 basis points per month, compared to only 17 points per month for firms going public in cold markets.[30]

Lowry (2003) finds that this conclusion regarding the greater underperformance of hot market IPOs is sensitive to test specification. Looking at abnormal returns of IPO firms relative to matched size and book-to-market portfolio benchmarks (1973 – 1996 period), she confirms that firms going public in the lowest IPO volume quartile periods tend to perform the best, but finds little evidence that abnormal returns are monotonic across the other quartiles or that the highest IPO volume quartile periods tend to perform the worst. Further, the negative relation between IPO volume and post-IPO performance is strongest when using raw returns, and weakest (and insignificant) when using size and book-to-market abnormal returns. She concludes that firms are more likely to go public when they and also other similar firms are valued more highly by the market.

However, it is important to note that ALL researchers agree that firms that go public during hot cycles do not perform well and investing in those IPOs results in a negative return on investment. The debate is whether this under-performance is unique to IPOs or also common to other non-IPOs with similar characteristics.

[30] Specifically, for each of the 240 calendar months within the sample period, Loughran and Ritter estimate a cross-sectional regression of monthly returns across all stocks on firm size, market-to-book, and an issue dummy equal to one if the firm had an IPO or SEO within the past five years.

## 8. Corporate Governance of IPO Firms

As noted by both Baker and Gompers (2003) and Field and Karpoff (2002), pre-IPO shareholders have strong incentives to implement a corporate governance structure that maximizes firm value. While the governance of mature firms generally represents the cumulative effects of many past decisions that may no longer be optimal for the firm, IPO firms start from a relatively blank slate; firms generally make many choices relative to governance shortly before going public. However, this is not to say that IPO firms are immune from agency issues. For example, powerful CEOs might strive to protect the control they wielded prior to the IPO, to ensure continued control after the firm goes public; or controlling shareholders may implement a structure that is not in the best interests of minority shareholders. The novelty of the corporate governance decisions of IPO firms combined their dynamics as firms mature makes IPO firms a particularly attractive setting in which to examine corporate governance.

As highlighted by Coles, Daniel and Naveen (2007), one-size-fits all formats for corporate governance are unlikely to be optimal. However, to the extent that the majority of research focuses on the same set of S&P1500 firms, our body of knowledge and associated regulatory changes are likely made based on one fairly homogenous set of firms, a concern voiced by Hermalin and Weisbach (2003). In a related vein, there is growing evidence that proxy advisory firms both have broad influence and base their recommendations on one-size-fits-all policies (see, e.g., Iliev and Lowry, 2015). Such practices have potential to harm newly public firms if they push these firms to implement policies that do not maximize firm value. In light of such issues, we focus our discussion on papers that highlight differences between IPO firms and their more mature counterparts, including the economic reasons for the differences and they ways in which these differences are likely to affect governance structures.

Motivated by firms' strong incentives to establish optimal structures when raising equity for the first time, Baker and Gompers (2003) was one of the early papers to focus on the governance structure of IPO firms. Their results highlight the positive influence of a concentrated shareholder such as a venture capitalist. Venture capitalists actively influence Board structure, as evidenced by the fact that the Boards of VC-backed firms tend to have more outsider directors. More reputable VCs are particularly influential, for example being more likely to fire the CEO prior to the IPO. However, the paper also demonstrates that agency issues can play a role even at this early point in a firm's life cycle. More powerful CEOs successfully limit the influence of VCs, for example by limiting the number of Board seats they hold. Hellmann and Puri (2002) provide further evidence on the ways in which venture capitalists influence start-up firms, for example in influencing human resource policies and encouraging the adoption of stock option plans.

Field and Karpoff (2002) highlight the ways in which agency issues play a role, at the time the firm is setting up its governance in preparation to go public. Within their sample of over 1,000 IPOs between 1988 and 1992, over 50% have at least one takeover defense at the time of the IPO. Their body of evidence is consistent with managers implementing these defenses as a means to maintain their private benefits of control.

The interplay of pre-IPO investors' demands for optimal governance structures combined with managers' incentives to maintain private benefits of control raises questions regarding the ways in which governance varies cross-sectionally and evolves over time, for example across firms whose businesses yield different demands for governance and whose ownership structures imply different private benefits of control. In this vein, Boone, Field, Karpoff and Raheja (2007) find that demands for monitoring, agency issues, and the power of the CEO all influence Board

structure. More complex firms demand larger Boards and more independent directors to perform the greater amount of monitoring. Firms in which there are more private benefits available to insiders also tend to have larger Boards to perform the necessary monitoring, but this relation is weaker in cases where the cost of monitoring is high, for example among firms with high return variance or high R&D. Finally, consistent with Hermalin and Weisbach (1998), CEO influence also plays an important role: CEO's with higher ownership and longer tenure have fewer independent directors on the Board, particularly in cases where there are fewer constraints on the CEO, for example when ownership of outside directors is low and there is no VC. As firms evolve over the years following the IPO, with firms generally becoming more complex and ownership of pre-IPO shareholders decreasing, the structure of the Board evolves as well.

This evidence on the evolution of the Board suggests that the governance of IPO firms should differ from that of more mature firms, an issue that Field, Lowry, and Mkrtchyan (2013) examine directly. Broadly speaking, the Board is tasked with monitoring and advising management. Field et al argue that newly public firms differ both in their demands for monitoring and in their demands for advising (compared to their more mature counterparts): the inexperience of management in running a public firm contributes to a high demand for advising, whereas the high ownership of pre-IPO owners leads to lower agency costs and thus a relatively low demand for monitoring. As such, these firms should seek to hire directors that have an expertise in advising, focusing less on their monitoring capabilities. In particular, IPO firms should benefit from busy directors, defined as directors that serve on three or more Boards, because such directors likely have substantial experience and connections that increase their value as advisors. The fact that they also likely have less time to diligently monitor the firm should be less of a concern, because of the relatively low agency costs in these firms. Empirical

tests focusing around the time of the IPO provide strong support for these conjectures. As firms mature, the type of director also changes in ways that are consistent with demands for monitoring increasing and demands for advising decreasing – specifically, firms choose far fewer busy directors as they mature.

Chahine and Goergen (2013, 2014) emphasize in several papers that IPO firms also likely differ in their access to high quality directors. Management is likely to have a smaller network, compared to their counterparts in more mature, larger firms. While not highlighted in these papers, we would argue that these effects are likely concentrated in firms that are not backed by a venture-capitalist.

Johnson, Karpoff and Yi (2015) provide further evidence on the ways in which IPO firms' have unique demands for governance. To the extent that IPO firms are more likely to be taken over after going public, for example because the owners have less control, a firm's business partners have reasons to be concerned. Specifically, if the IPO firm is taken over, the pre-existing relationships become more uncertain. The IPO firm can protect the value of these relationships through the use of take-over defenses. Consistent with these arguments, Johnson et al find that among firms with such relationships, the use of takeover defenses is positively related to the longevity of these relationships and to post-IPO operating performance.

Johnson et al's findings are consistent with the more general argument that anti-takeover provisions can potentially provide a benefit, in addition to a cost. The benefit is that it allows the firm to pursue a longer-term growth strategy. A firm with lower risk of being subject to a takeover is less concerned with short-term results. This is beneficial if it gives managers the flexibility to pursue long-term positive NPV projects, but costly if it allows managers to enjoy the quiet life or otherwise overconsume perquisites.

Perhaps reflecting differences in these cost-benefit trade-offs, Field and Lowry (2017) show striking differences between IPO firms and more mature firms in the choice to have a classified board. The percent of IPO firms with classified boards has increased from 40% in 1990 to nearly 80% as of 2014. In stark contrast, the percent of mature firms with classified boards has decreased from 60% to 40% over the same period. Coincident with these trends, the percent of IPOs firms incorporating in Delaware has also dramatically increased, from 57% to 88%, a decision that arguably decreases litigation-related uncertainty for firms (see, e.g., Romano, 1985). Field and Lowry conjecture that these trends in IPO firms' governance choices are related to an increase in activism, in particular by proxy advisory firms such as ISS. If entities such as ISS fail to appreciate the unique governance demands of IPOs, for example the directors who are best qualified to advise the newly public firms, then the firm might be at greater risk of suboptimal outcomes in shareholder votes. Firms can potentially protect themselves from such risks by only putting directors up for vote every three years, i.e., by having a classified board. An analysis of voting data provides support for these conjectures.

Field and Lowry also find cross-sectional differences in these time trends, with the trend toward classified board being particularly high among R&D intensive firms. This is consistent with Manso's (2011) hypothesis that that a long-term focus, as would be facilitated by a classified board, encourages innovation. In a similar vein, Baranchuk, Kieschnick, and Moussawi (2014) find that IPO firms focused on innovation tend to employ incentive compensation and long vesting periods.

The governance structure that provides the strongest protection to management is arguably a dual-class structure. Conditional on the B-shares having sufficient voting power, it is impossible to oust management. Consistent with this, Smart and Zutter (2003) find that firms

that go public with a dual class structure experience far fewer control events. Moreover, consistent with agency costs being higher in such firms, Smart and Zutter also find that the stock of dual-class firms trades at lower values, and top management receives higher compensation. Similarly, Arugaslan, Cook, and Kieschnick (2010) conclude that dual class structures are driven by private benefits of control, rather than an effort to focus managers on the long-term rather than short-term stock fluctuations. As with much of the earlier research in corporate governance, a potential concern relates to the possibility that dual class structures are concentrated within certain types of firms, and these firm typ

Aes tend to have offer higher compensation irrespective of whether they have dual-class stock. Future research that can better address these issues is important, particularly in light of the fact that while dual class structures are becoming less common in mature firms, Field and Lowry document no evidence of such a decline in IPO firms. In fact, many of the high-flying IPOs, such as Google, Facebook Twitter and more went public with dual-class share structure.

Consistent with theory, Kim and Michaely (2017) find that the benefits of dual class shares vary with firm age, where dual class structure is more beneficial on net for young firms. They find no evidence of a dual-class valuation discount for young firms, while there is a significant discount for old firms. In addition, young dual-class firms show marginally higher ROA and operating margins than young single-class firms, while old dual-class firms exhibit statistically indistinguishable performance from old single-class firms. In contrast to these findings on operating profitability, they find evidence that old dual-class firms use “assets-in-place” (capital and labor stocks) less efficiently than older single-class firms, but again, this is not the case for young firms. In particular, old dual-class firms have significantly lower asset turnover and labor productivity, and their capital expenditures and employment changes are

significantly less responsive to changes in Tobin's q, a proxy for investment opportunities, all relative to old single-class firms. These results suggest that old dual-class firms may face higher costs of capital due to higher capital and labor adjustment costs. Consistent with this explanation, they find that old dual-class firms' equities have significantly higher loadings on the Fama-French value factor and higher expected returns.

In a similar vein, Johnson, Karpoff and Yi (2016) find that the value of takeover defenses declines as firms age, where they examine the six provisions in the E-index: classified boards, poison pills, golden parachutes, and supermajority requirements to change firm bylaws, to change the firm charter, and to approve mergers. They argue that while companies would optimally remove such defenses as they progress through the life cycle, takeover defenses are sticky. As a result, older firms in many cases continue to have defenses that no longer contribute positively to firm value.

The underlying assumption of a strong corporate governance structure is that this positively affects the quality of management, for example because directors incur the greater costs of searching for higher quality management to hire and because they are more likely to fire underperforming managers. Chemmanur and Paeglis (2005) evaluate directly the effects of management quality in IPO firms.[31] In addition, to providing informative descriptives across this wide set of factors, the documented relations between these metrics and firm outcomes confirms the importance of a high quality management team. Specifically, all else equal, firms with higher quality management teams successfully hire more reputable underwriters, raise more

[31] The authors characterize management quality as higher if: the firm has a greater number of officers of rank vice-president or higher adjusted for firm size; a greater percentage of firm management has an MBA degree; a higher percentage of the management team has past work experience as a vice-president or higher or past experience as a partner in a law or accounting firm; average tenure of the management team is higher, suggesting greater cohesion of the team; a greater number of non-profit Boards on which the management team sits. In addition, the authors also consider CEO dominance, measured as the percent of total management compensation earned by the CEO.

equity in the IPO, and attract more institutional investors. In the long-run, there is some evidence of a positive relation between the quality of the management team and performance. The authors focus on non-VC backed firms in this paper, to ensure that they capture the effects of management per se, rather than the VC. In a more recent paper, Chemmanur, Simonyan and Tehranian (2014) find that the VC has a direct effect on management quality, and that within VC-backed firms both the venture capitalist and the quality of the management influence post-IPO outcomes of the firms.

In addition to choosing management, the Board of Directors also controls the compensation of top management. While there has not been a lot of research on compensation within IPO firms, Pukthuanthong, Roll, and Walker (2007) document that the average firm has a substantial number of options at the time of the IPO with options equal to 50% of shares offered in the IPO. They find that a balanced combination of equity ownership and options is positively related to post-IPO operating performance, which they argue is consistent with the options providing higher incentives but potentially encouraging excessive risk taking, where the latter influence can be mitigated through equity ownership.

Finally, one of the important aspects of studying the corporate governance of IPOs is that it can potentially inform us on issues beyond IPOs. For example, it can inform us on the importance of fitting the firm's governance to the firm's life cycle stage. Young firms may not have the same optimal governance structure as more mature firms. For example, concentrated ownership (or equivalently dual class share structure) may be beneficial early on in the life of the firm. It may have a different effect on value for more mature firms. Examining these dynamics around the IPO is informative. Consistent with these ideas, the evidence on the evolution of the

Board suggests that the governance of IPO firms should differ from that of more mature firms. Similar effects likely apply for takeover provisions.

## 9. Conclusion

Public markets are an essential element of well-functioning capital markets. Public markets can potentially lower firms' cost of capital, enable the general public as well as entrepreneurs to hold diversified portfolios, allow for liquidity at relatively low costs, and facilitate effective monitoring of firms. By implication, it is essential that private, typically young firms move from the private to the public market by offering their shares to the public. This process, the IPO process, is what we have attempted to describe and explain in this chapter.

This chapter both provides an overview of the many parties involved in bringing a firm public and highlights the ways in which the incentives of each influence the entire process. The IPO company's management, who in many cases represent the firm's founders, are generally motivated by a combination of maximizing shareholder value and retaining some private benefits of control that they may have enjoyed while the firm was private. However, this management also in many cases has limited experience with the IPO process, which potentially makes them more dependent on intermediaries. Intermediaries are generally more experienced, but there exist the potential for agency costs within each: the venture capitalists and banks that provide funding to the firm in its more nascent stages, the underwriters that manage the firm's first public equity offering, and the institutions and analysts that potentially influence the stock price once the firm is public. Finally, layered on top of all of these various incentives, evidence suggests that behavioral biases within the public markets also influence the price at which companies' can raise capital.

In aggregate, all of these factors influence the costs and benefits of going public. It is important to remember that if going public was all good, i.e., that there were only benefits to going public, many more firms, would have gone public. There are costs involved in both the

process and the outcome (being public); and these costs vary among firms. In the wake of the recent downturn in the number or companies going public, several recent papers have attempted to shed light on the costs versus benefits of being a publicly traded firm versus a private firm. In a frictionless, Modigliani and Miller (1958, 1961) world, private and public firms should behave similarly: capital structure should be irrelevant, cost of capital should not vary across firms, and firms should take all positive NPV projects. However, once frictions are introduced, theory suggests various differences.

Consistent with theory, empirical evidence has found significant differences. For example, consistent with public listing lowering information asymmetry and increasing liquidity, Brav's (2009) examination of private and public firms in the United Kingdom leads him to conclude that private firms have a higher cost of capital.

Empirical literature regarding the effects of public listing on investment behavior are more nuanced. Together, findings from Gilje and Taillard (2016) and Asker, Farre-Mensa and Ljungqvist (2015) demonstrate that public listing can have both a positive and a negative effect. On the one hand, public firms' increased access to capital makes them better able to undertake positive NPV projects, an advantage that is particularly significant among capital-intensive positive projects. However, public firms also suffer from heightened agency-related issues such as managerial myopia, which causes more short-term managers to avoid some positive NPV projects. Bernstein (2015) and Gao, Harford and Li (2013) provide added evidence suggesting that agency costs influence the investment behavior of public firms relative to their private counterparts, causing them both to engage in less innovation and to hold substantially more cash.

In sum, a growing body of literature employs samples of private and public firms, combined with clever empirical specifications, to highlight both the benefits as well as the costs

of public listing. While public listing confers benefits such as a lower cost of capital, it comes with the nontrivial cost of higher agency-related issues that can distort investment decisions. Further research along these dimensions is important, particularly in light of the decreasing numbers of companies going public.

As we highlighted throughout this chapter, there are other issues related to the IPO process where we feel further research is warranted. There are many potential reasons why firms may want to go public, but it is not clear we have a good understanding which are the dominant drivers behind the decision. This is of first order importance. The answer to this question is not only important in its own right but can also help understand other phenomena such as why firms are underpriced at the time of the IPO and when firms choose to go public.

Another unresolved issue is the optimal going public mechanism. On the face of it, a mechanism that results in an average of 16.4% first day return and which has an opaque allocation mechanism that is subject to possible abuses is unlikely to be the optimal mechanism. We need a better understanding why bookbuilding is still the most common and dominant going public venue. And this issue may also be related to the high fees extracted by underwriters through the process.

Finally, how to structure the optimal corporate governance for young firms is another open question. For example, we are seeing a large number of IPOs coming out to the market with a anti-takeover devices such as a classified board and a dual share structure; which are generally viewed as suboptimal among mature firms. It is possible and quite likely that considering the dynamics of corporate governance and how it is related to firms' maturity will yield new and interesting insights.

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**Figure 1. Number of IPOs and Aggregate Proceeds.**

The IPO sample is constructed based on information from the SDC Platinum database. The sample consists of companies that went public between 1972 and 2015 on NYSE, Nasdaq and AMEX stock exchanges. IPOs with an offer price below $5, REITs, ADRs, units, and companies without CRSP records are excluded. The final sample includes 8,543 IPOs. Proceeds (obtained from SDC) are expressed in real 2015 billion dollars, using the GDP implicit price deflator.

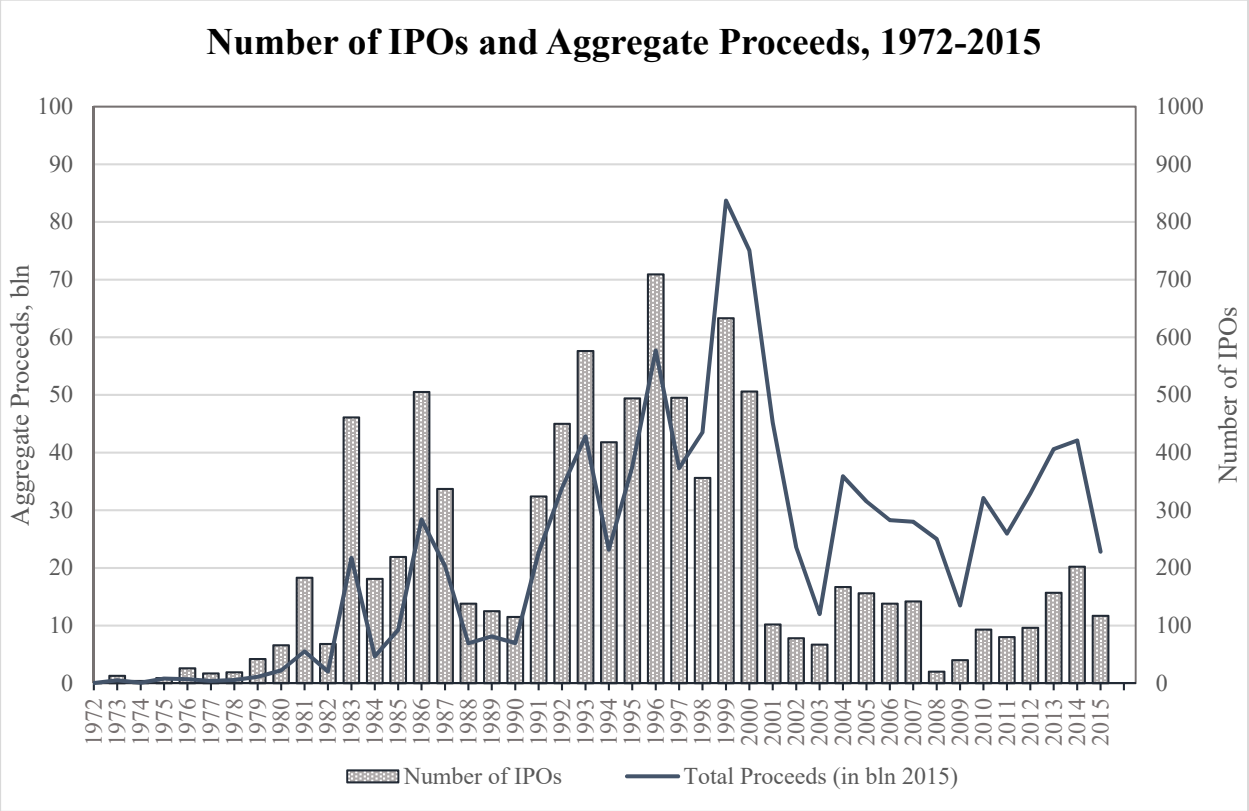


**Figure 2. Number of IPOs and Initial Returns**

The IPO sample is constructed based on information from the SDC Platinum database. The sample consists of companies that went public between 1972 and 2015 on NYSE, Nasdaq and AMEX stock exchanges. IPOs with an offer price below $5, REITs, ADRs, units, and companies without CRSP records are excluded. The final sample includes 8,543 IPOs. Initial returns equal the return from the offering price to the first day closing price, where the offer price is from SDC and the first closing price from CRSP.

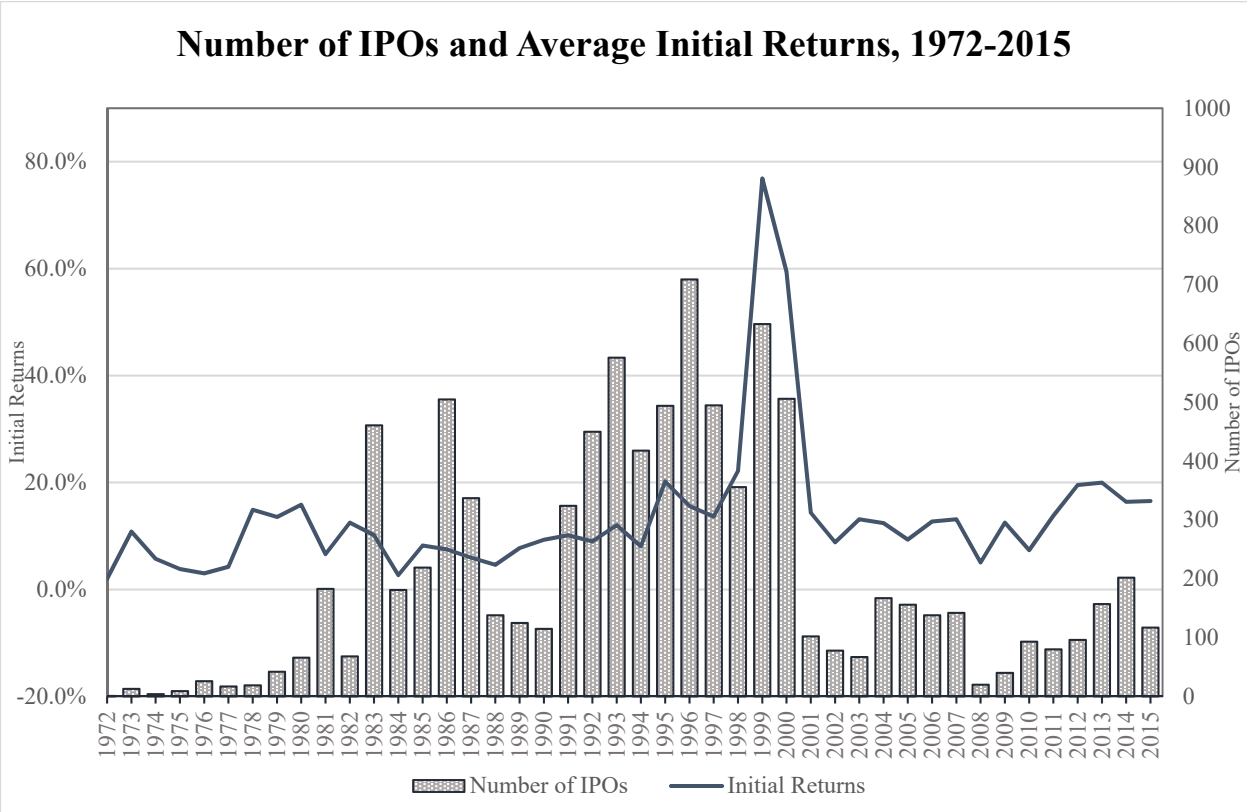


**Figure 3. Initial Returns and Aggregate Proceeds.**

The IPO sample is constructed based on information from the SDC Platinum database. The sample consists of companies that went public between 1972 and 2015 on NYSE, Nasdaq and AMEX stock exchanges. IPOs with an offer price below $5, REITs, ADRs, units, and companies without CRSP records are excluded. The final sample includes 8,543 IPOs. Initial returns equal the return from the offering price to the first day closing price, where the offer price is from SDC and the first closing price from CRSP. Proceeds (obtained from SDC) are expressed in real 2015 billion dollars, using the GDP implicit price deflator.

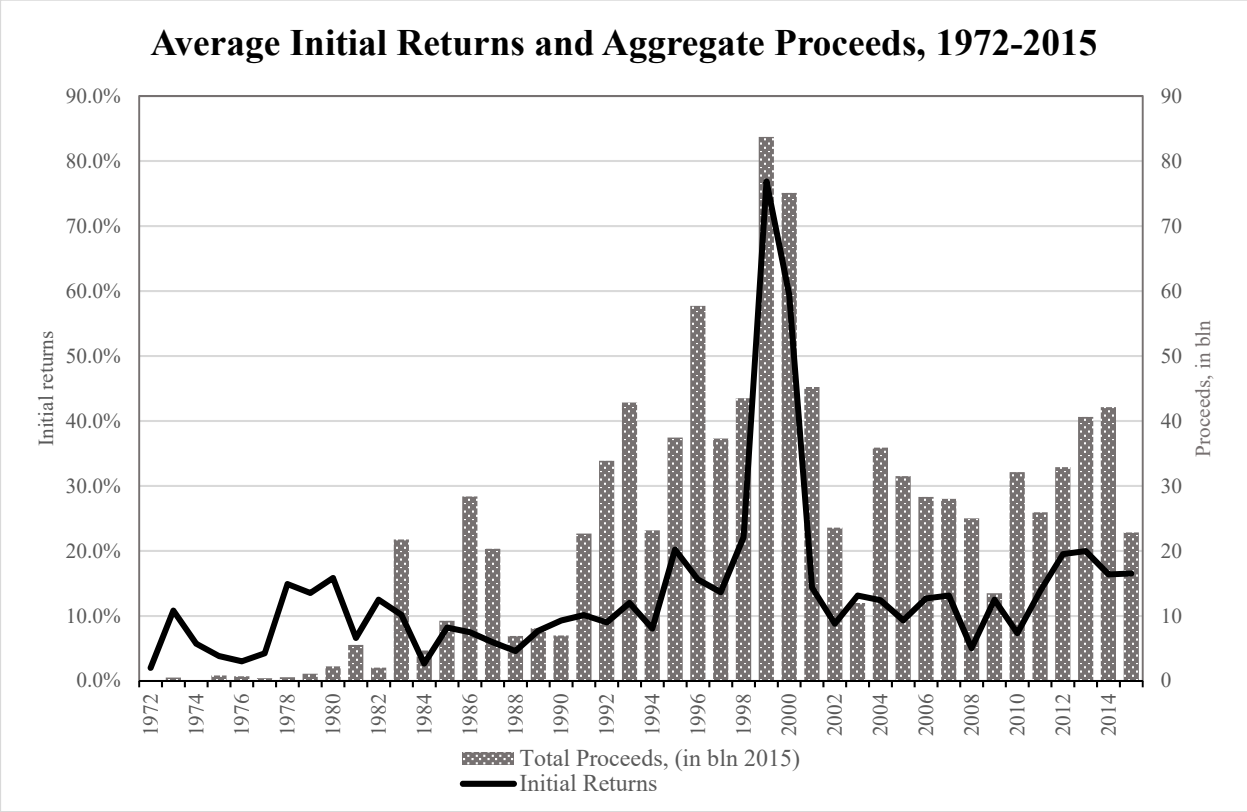


**Figure 4. IPO Initial Returns and Proceeds.**

This figure presents the number of IPOs and average initial returns within three groups: IPOs with proceeds below $30 million, IPOs with proceeds between $30 million and $120 million, and IPOs with proceeds above $120 million. Proceeds are in real 2015 dollars. Further details on the sample composition are provided in Figure 1.

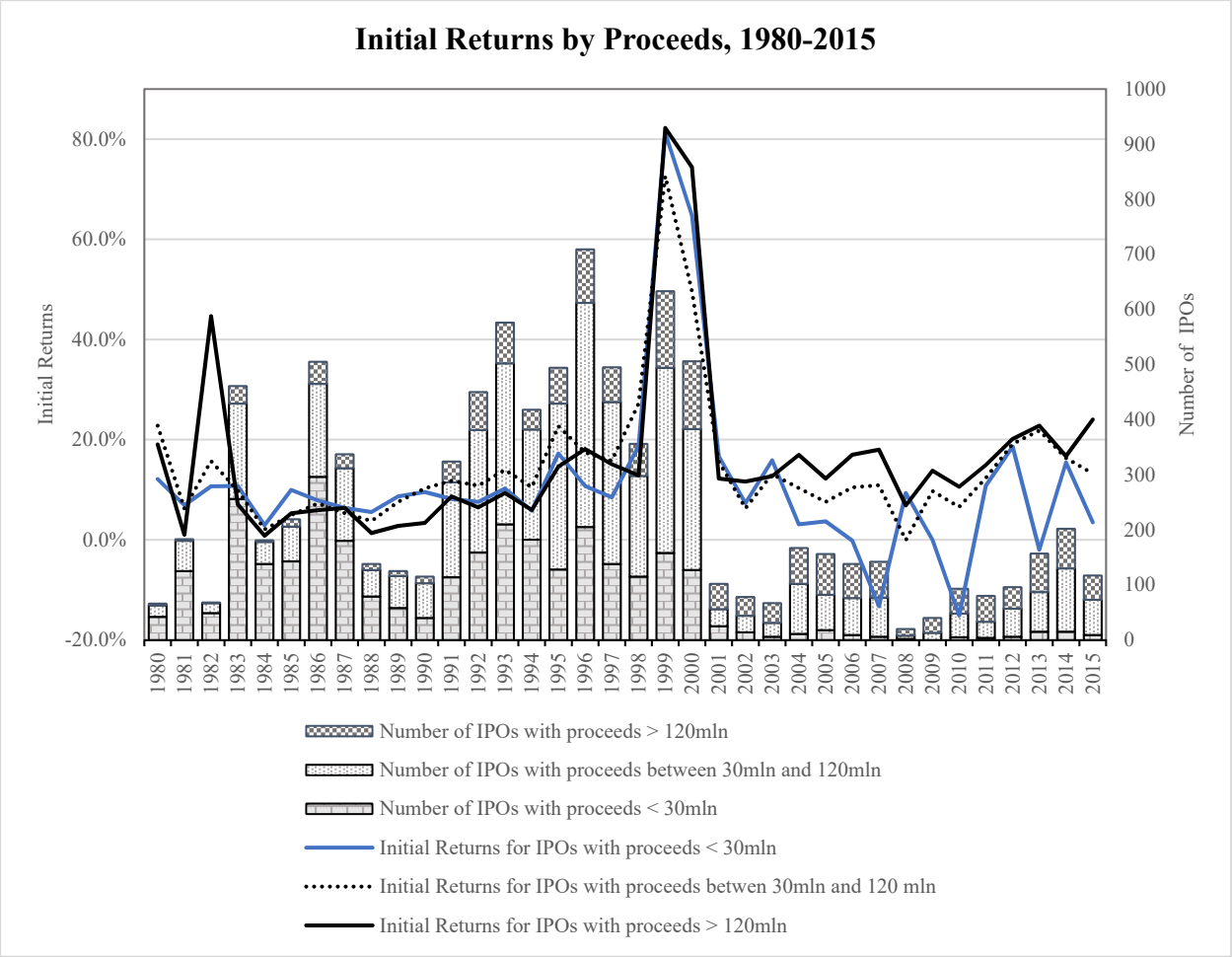


**Figure 5. IPO Initial Returns and Initial Price Range.**

This figure presents the number of IPOs and average initial returns for three groups: IPOs with whose offer price is below the initial price range, within the initial price range, and above the initial price range. Further details on the sample composition are provided in Figure 1. The sample in this figure is additionally restricted to companies that went public in 1983 - 2015, as SDC does not have the initial price range information for IPOs in earlier years.

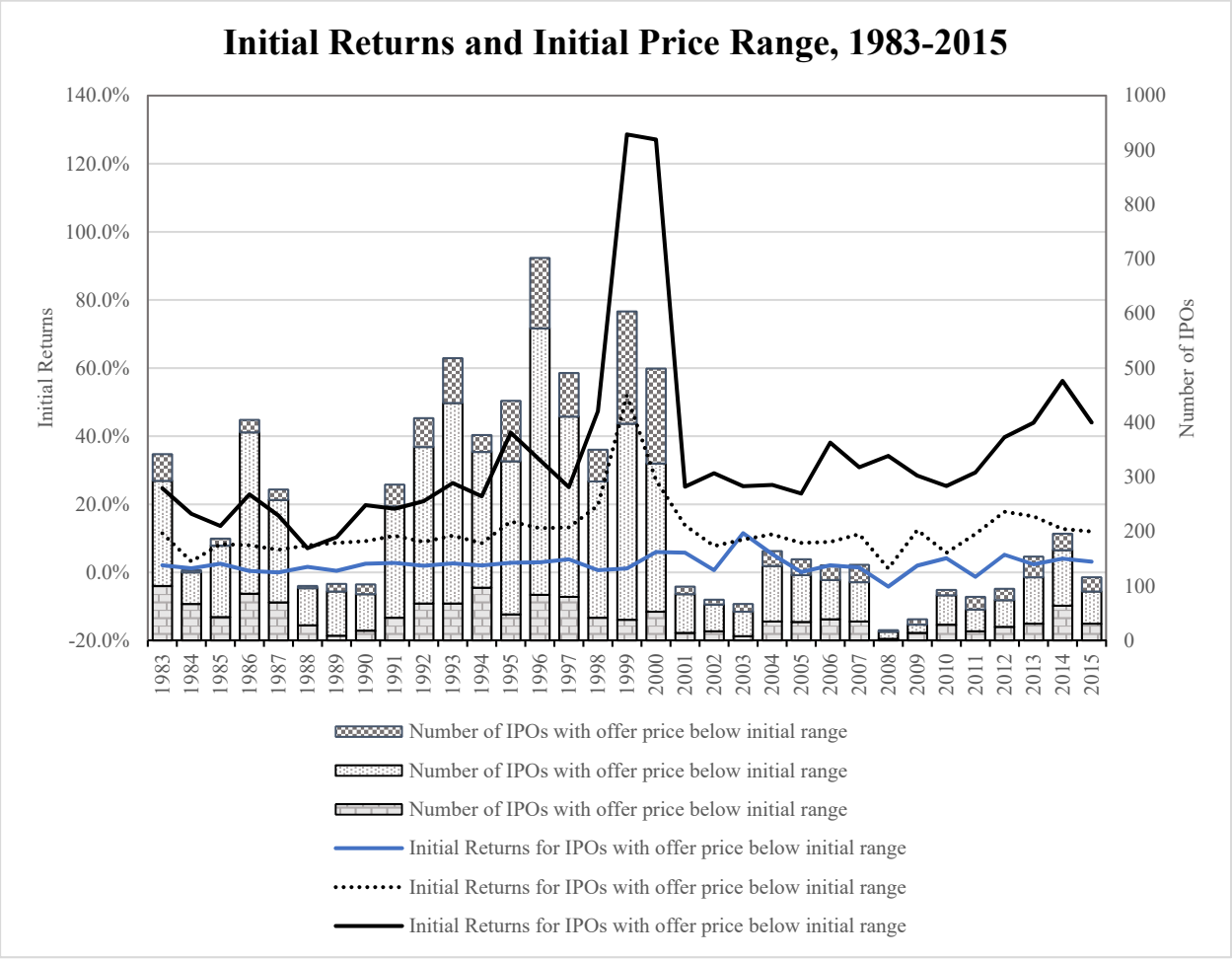


**Figure 6. IPO Initial Returns and Venture Capital Backing**

This figure shows the number of and the average initial returns for IPOs with and without venture capitalist backing. Information on VC backing is obtained from SDC. Further details on the sample composition are provided in Figure 1. The sample in this figure is additionally restricted to companies that went public between 1980 and 2015.

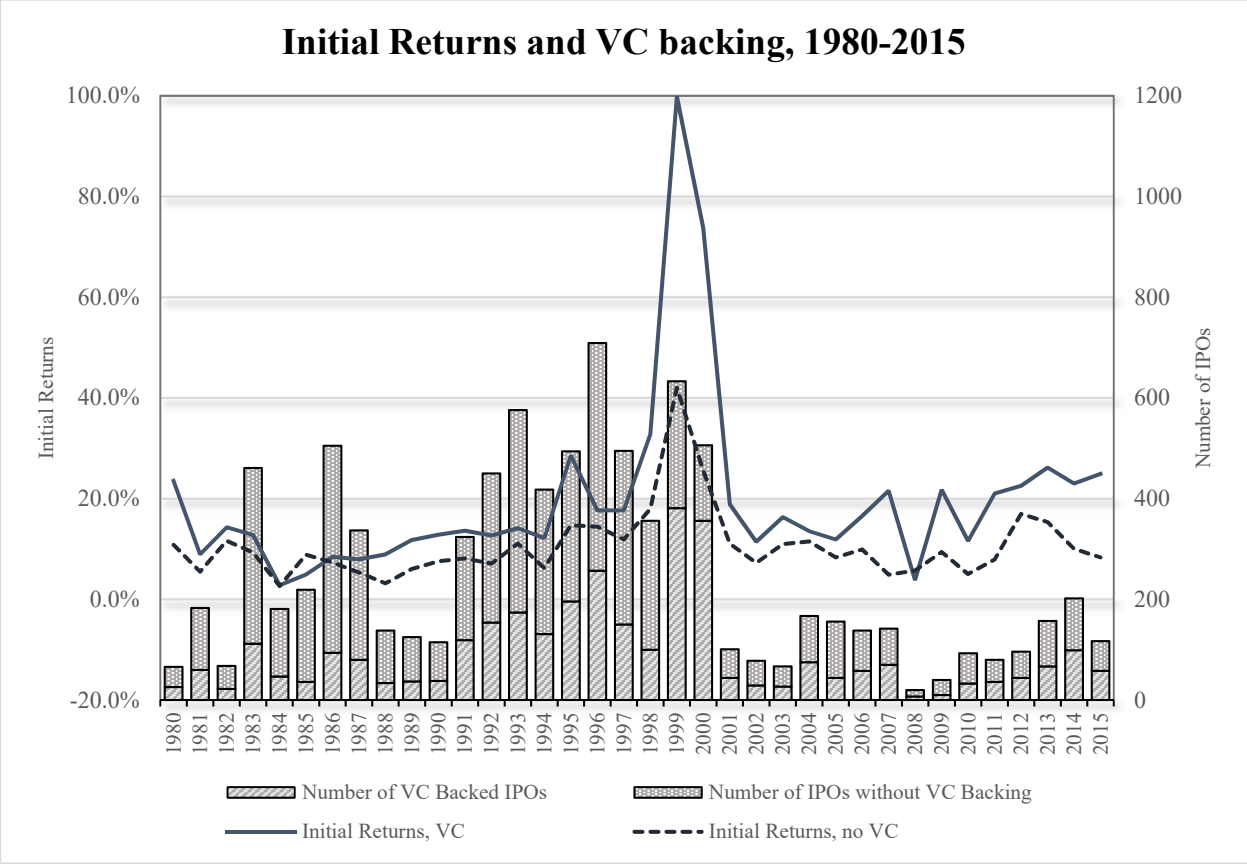


**Figure 7. Underwriter Spread**

This figure shows the portion of IPOs per year with the underwriter spread below, equal to and above 7%. Information regarding the underwriter spread is obtained from SDC. The composition of the IPO sample is described in Figure 1, and the sample in further restricted to offerings in 1980-2015 with non-missing information on the underwriter spread.

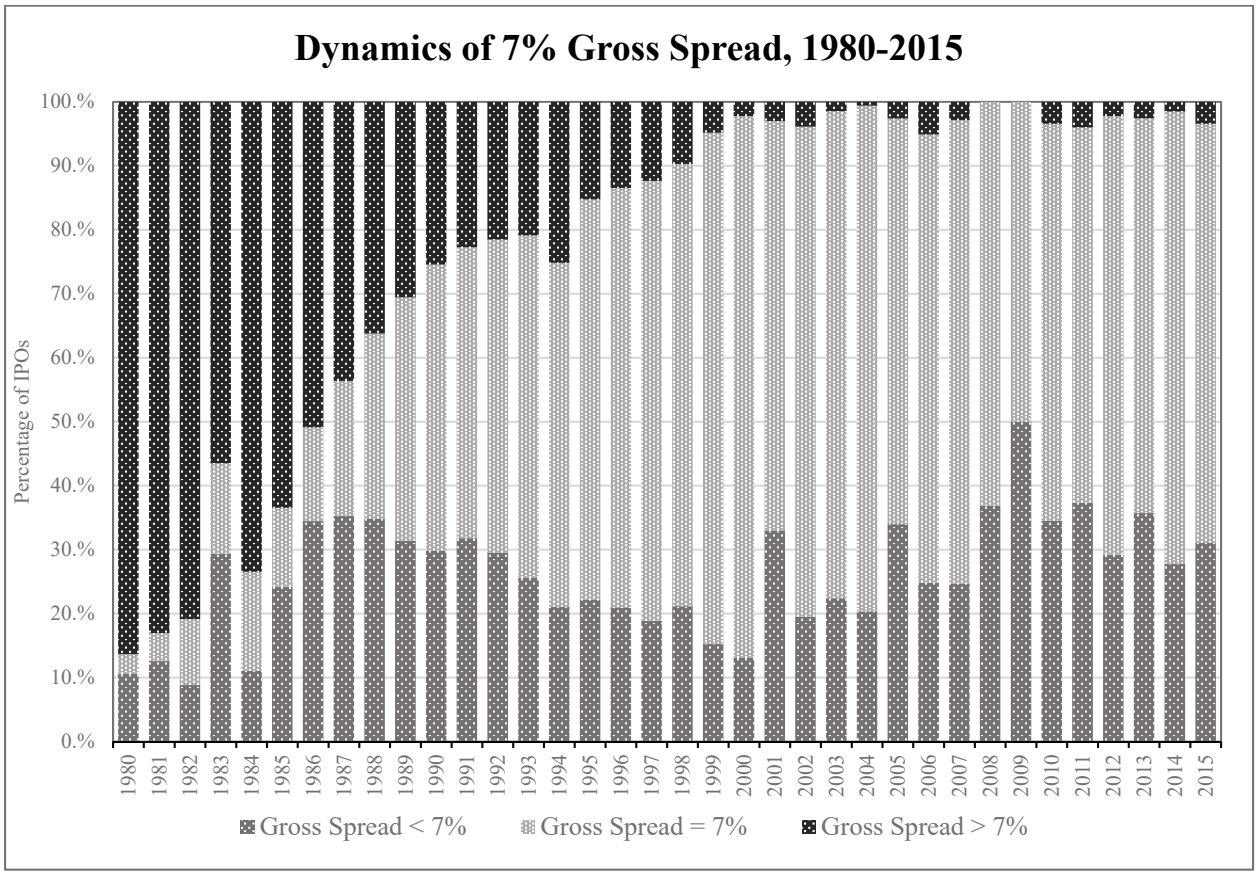


**Figure 8. Average Underwriter Spread and IPO proceeds.**

This figure shows the time-series dynamics of the average underwriter spread for IPOs with proceeds below $30 million, between $30 million and $120 million, and above $120 million. Proceeds are in real 2015 dollars. Information regarding the underwriter spread is obtained from SDC. The composition of the sample is described in Figure 1, and the sample is further restricted to IPOs between 1980 and 2015 with non-missing information on the underwriter spread.

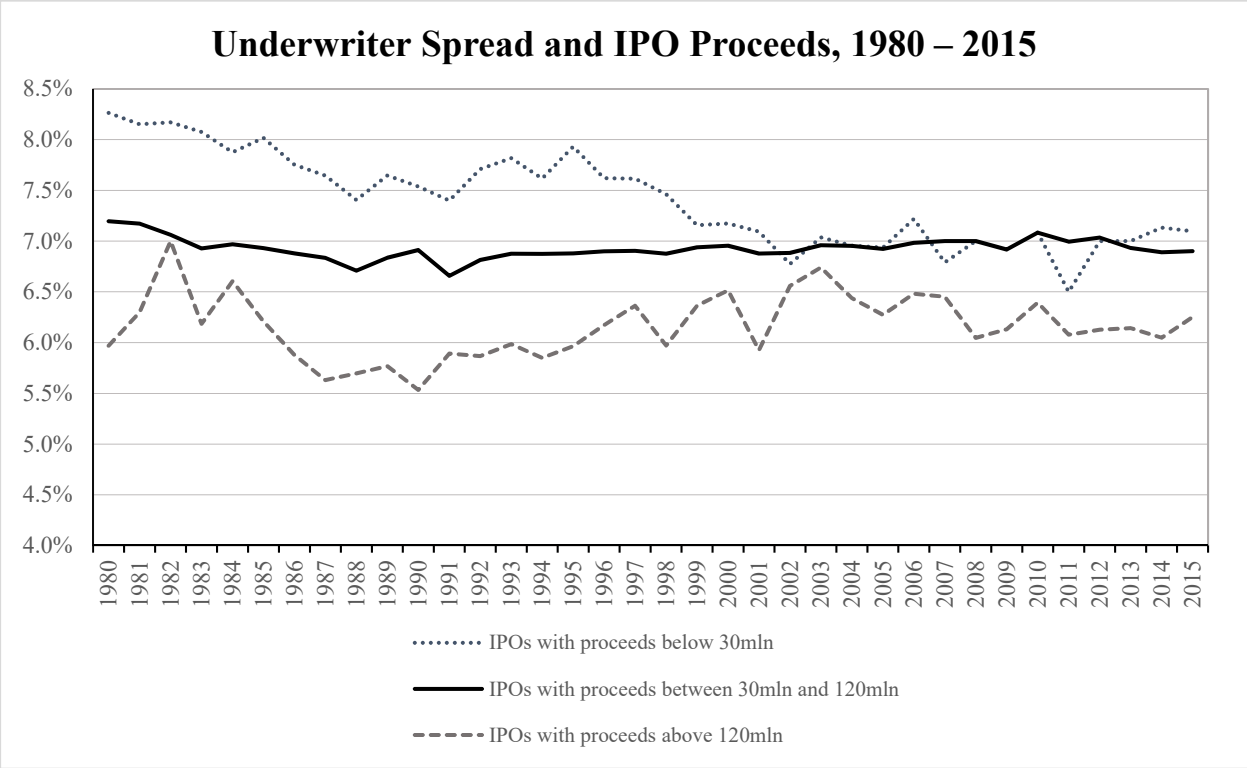
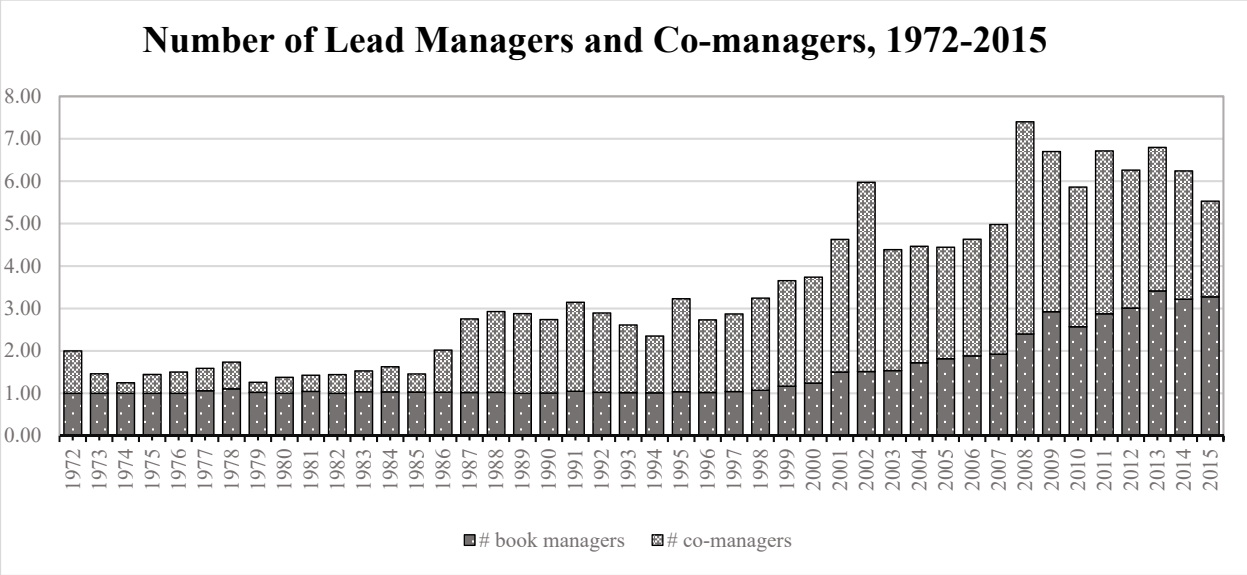


**Figure 9. Investment Banks and IPO**

Panel A shows the time-series dynamics of the average number of lead and co-managers in IPOs. Panel B shows the number of syndicate members, classified by lead, co-manager, and other syndicate members, each year between 1997 and 2015. Information about the managers and syndicate members is obtained from SDC, where codes "BM", "JB", "JL" (which stand for book manager, joint book and joint lead, respectively) are defined as lead managers, "CM" as co-managers, and "SD" as other syndicate members. The composition of the sample is described in Figure 1.

*Panel A. Number of IPO Lead Managers and Co-managers*




*Panel B. Syndicate Size*

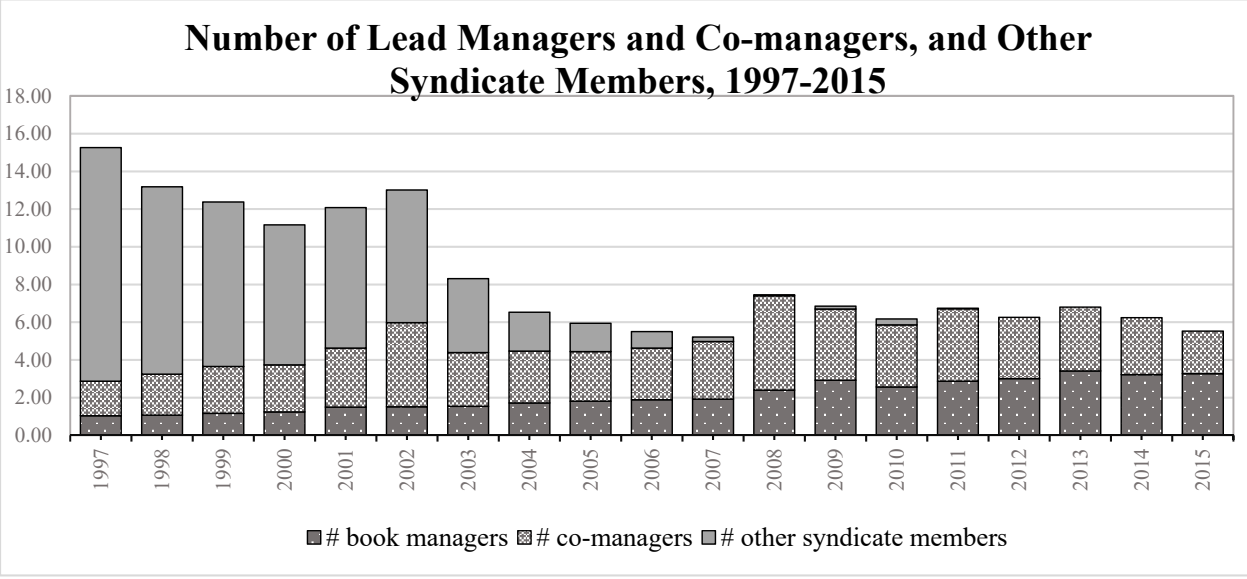


**Figure 10. Number of IPO and Registration Period**

This figure shows the average registration period length and the number of IPOs each year. Registration period length is defined as the number of days between the filing of the first IPO prospectus and the IPO offer date, where both variables are taken from SDC. The composition of the sample is described in Figure 1, and the sample is further restricted to the companies that went public between 1983 and 2015 as SDC does not include information on the filing date prior to 1983.

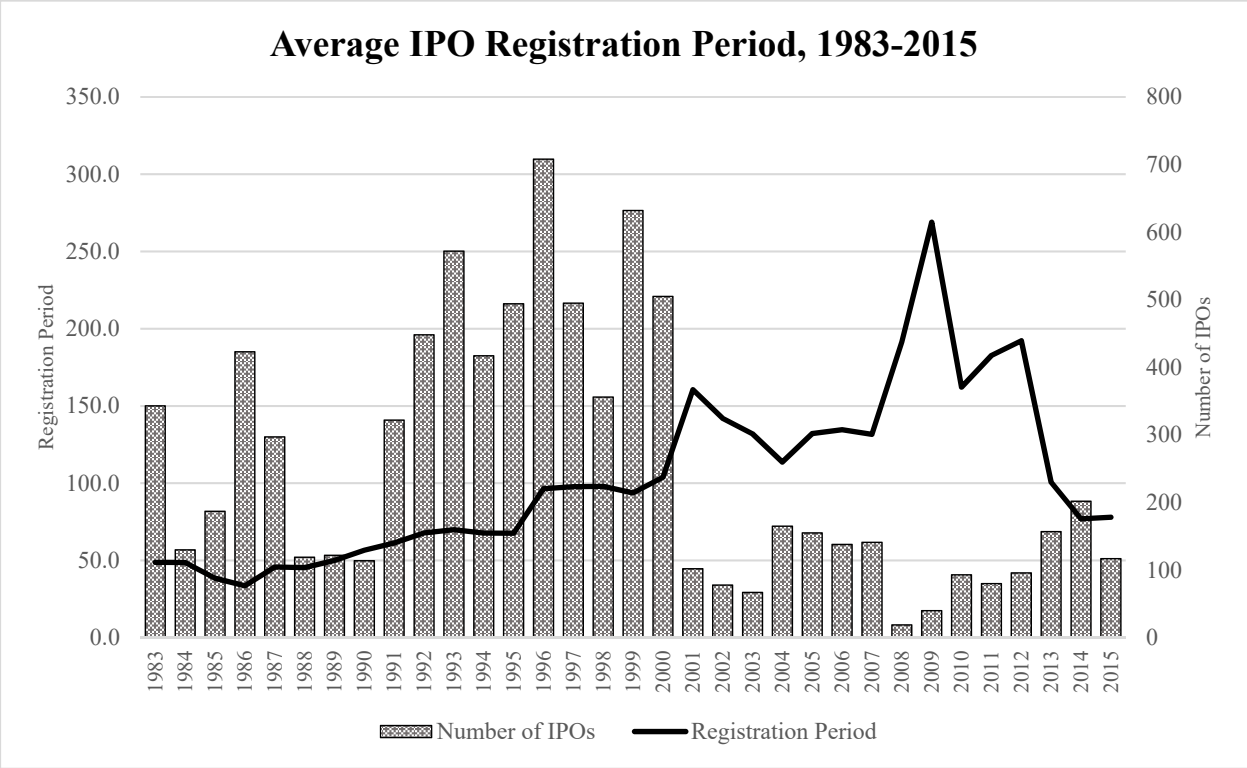


**Figure 11. Registration Period and Number of SEC letters.**

This figure shows the relation between the length of the registration period and the number of SEC comment letters regarding the IPO prospectus. The sample consists for IPOs between 2005 and 2013 for which we are able to download SEC letters from EDGAR, as described further in Lowry at el (2016).

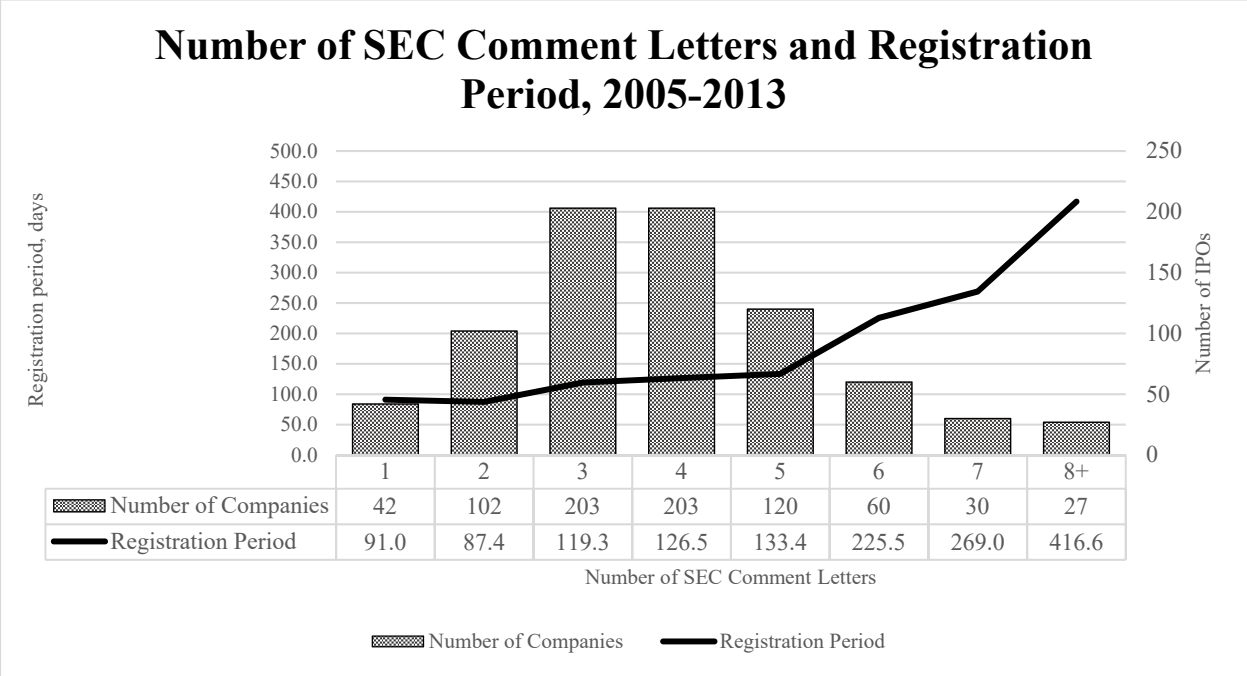
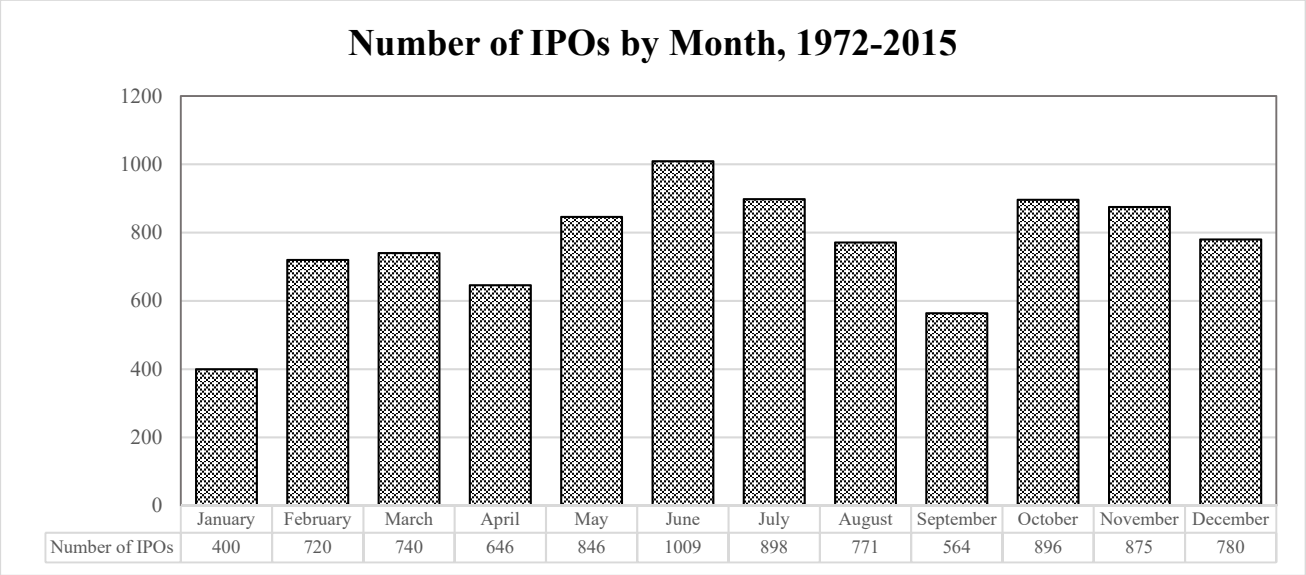


**Figure 12. Monthly and Weekly Paterns of the IPO Date.**

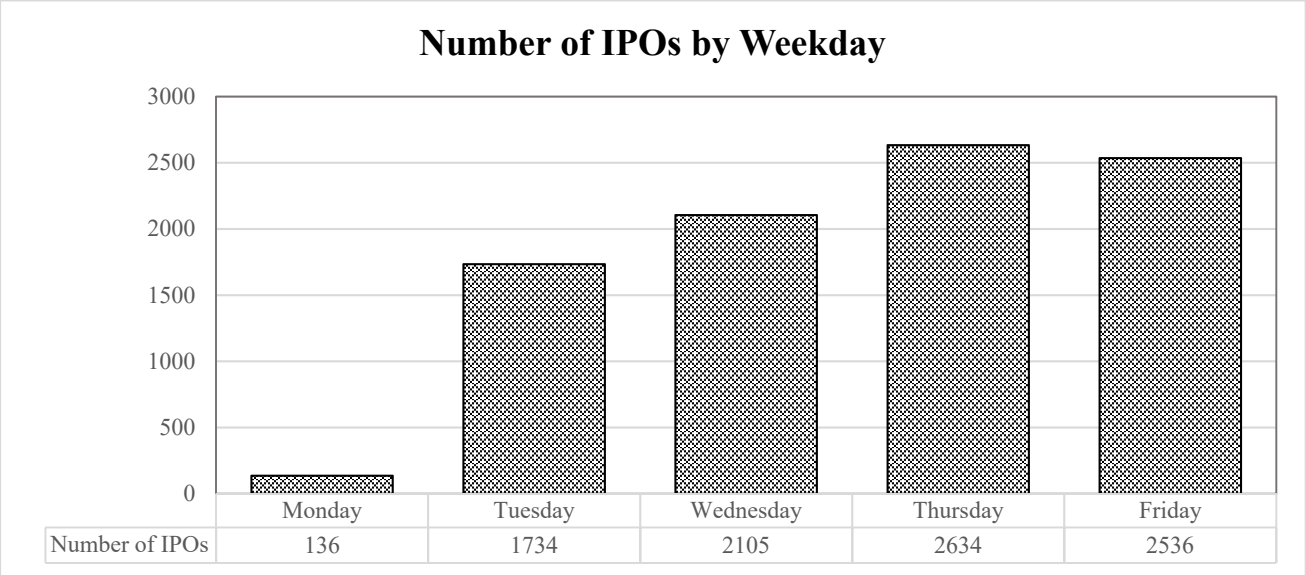
Panel A shows the total number of companies that went public in a given calendar month, over the 1972 – 2015 period. Panel B shows the total number of companies that went public on a given day of the week, over the 1972 – 2015 period. The composition of the sample is described in Figure 1.

*Panel A. Number of IPO by Month*




| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of IPOs | 400 | 720 | 740 | 646 | 846 | 1009 | 898 | 771 | 564 | 896 | 875 | 780 |

*Panel B. Number of IPO by Weekday*




| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Number of IPOs | 136 | 1734 | 2105 | 2634 | 2536 |

**Figure 13. Dynamics of Nominal IPO Offer Price.**

This figure shows the time-series dynamics of the average nominal offer price for IPOs with proceeds below $30 million, between $30 million and $120 million, and above $120 million. Proceeds are in real 2015 dollars. The composition of the sample is described in Figure 1.

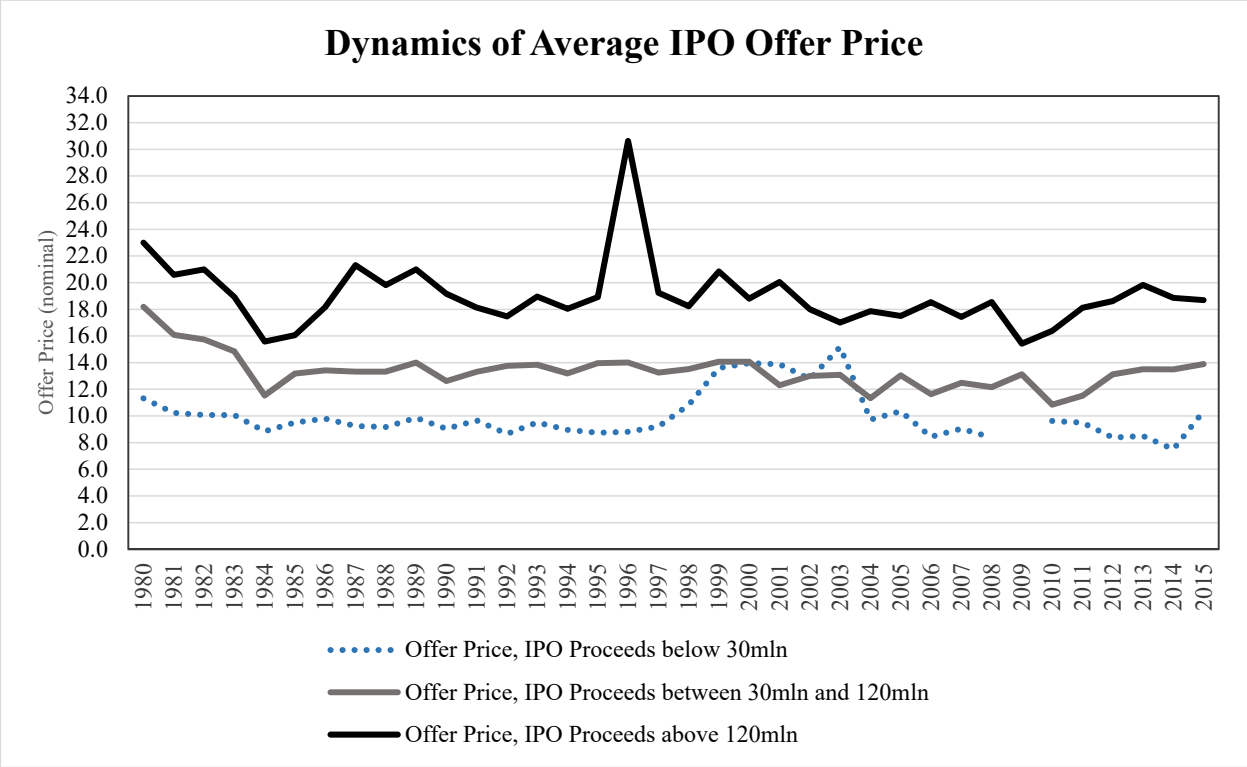
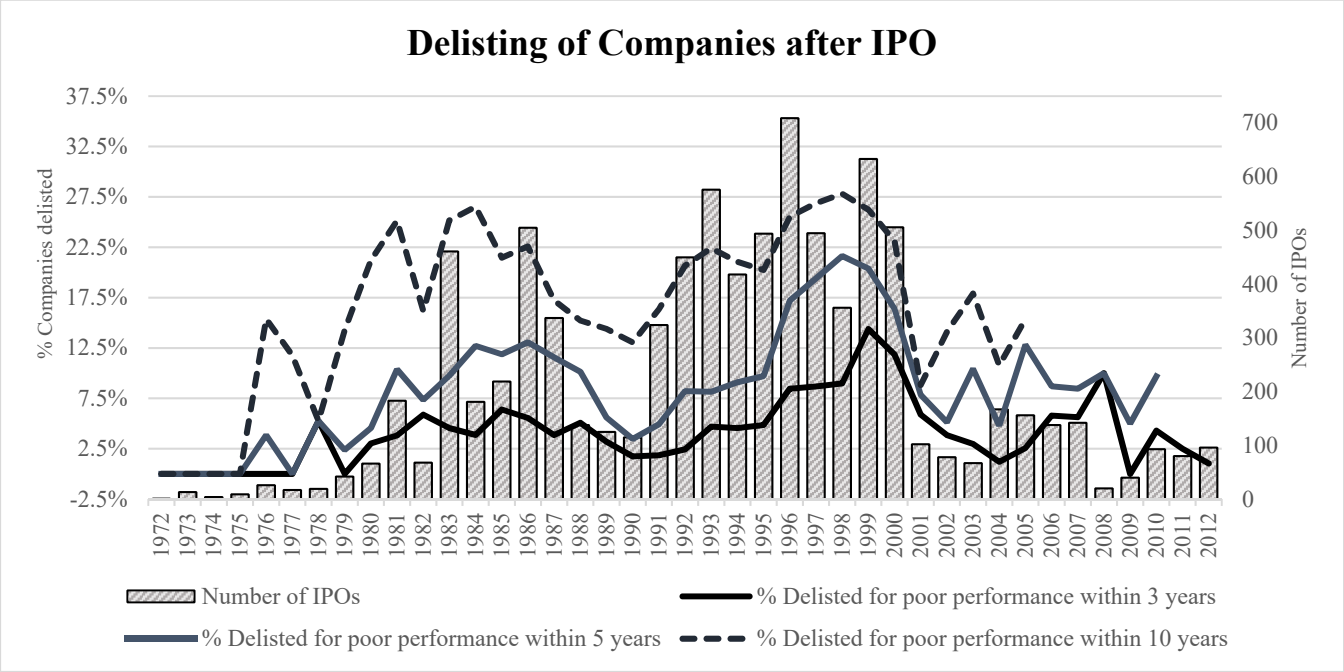


**Figure 14. Delisting and Acquisition of the Companies after IPO.**

Panel A shows the percent of IPOs delisted for the poor performance within 3, 5 and 10 years after the offering. Panel B shows the percent of IPOs that were acquired within 3, 5 and 10 years after the offering. Delisting and acquisition information are obtained from CRSP. The composition of the sample is described in Figure 1.

*Panel A. Delisting for Poor Performance*




*Panel B. Acquisition after IPO*

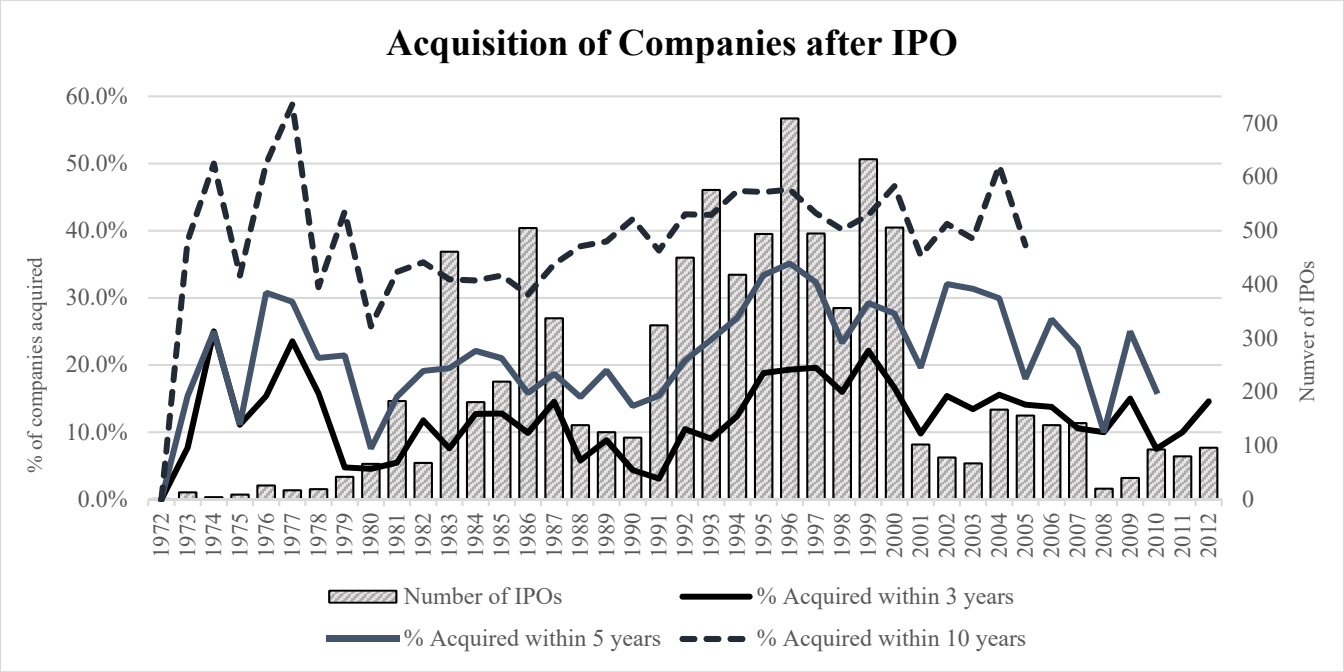


**Table 1. Mean IPO Initial Returns and Average Proceeds, 1972-2015**

The IPO sample is constructed based on information from the SDC Platinum database. The sample consists of companies that went public between 1972 and 2015 on NYSE, Nasdaq and AMEX stock exchanges. IPOs with an offer price below $5, REITs, ADRs, units, and companies without CRSP records are excluded. The final sample includes 8,543 IPOs. Proceeds (obtained from SDC) are expressed in real 2015 million dollars, using the GDP implicit price deflator. Initial returns equal the return from the offering price to the first day closing price, where the offer price is from SDC and the first closing price from CRSP.

| Year | # IPOs | Initial Returns | Average Proceeds (mil) | Aggregate Proceeds (mil) |
|---|---|---|---|---|
| 1972 | 1 | 2.0% | 43.9 | 43.9 |
| 1973 | 13 | 10.8% | 39.0 | 507.3 |
| 1974 | 4 | 5.7% | 24.1 | 96.3 |
| 1975 | 9 | 3.8% | 91.1 | 820.2 |
| 1976 | 26 | 3.0% | 26.9 | 699.5 |
| 1977 | 17 | 4.3% | 23.7 | 402.8 |
| 1978 | 19 | 14.9% | 29.1 | 553.5 |
| 1979 | 42 | 13.5% | 26.4 | 1,110.3 |
| 1980 | 66 | 15.8% | 33.9 | 2,237.5 |
| 1981 | 183 | 6.6% | 30.2 | 5,529.9 |
| 1982 | 68 | 12.5% | 30.0 | 2,037.6 |
| 1983 | 461 | 10.2% | 47.2 | 21,747.1 |
| 1984 | 181 | 2.7% | 25.9 | 4,679.7 |
| 1985 | 219 | 8.2% | 42.3 | 9,259.9 |
| 1986 | 505 | 7.5% | 56.2 | 28,384.6 |
| 1987 | 337 | 6.0% | 60.3 | 20,322.7 |
| 1988 | 138 | 4.6% | 50.1 | 6,917.1 |
| 1989 | 125 | 7.7% | 64.8 | 8,103.4 |
| 1990 | 115 | 9.3% | 60.7 | 6,977.4 |
| 1991 | 324 | 10.1% | 70.0 | 22,674.8 |
| 1992 | 450 | 9.0% | 75.3 | 33,865.1 |
| 1993 | 576 | 12.0% | 74.4 | 42,830.2 |
| 1994 | 418 | 8.1% | 55.4 | 23,152.0 |
| 1995 | 494 | 20.2% | 75.8 | 37,445.8 |
| 1996 | 709 | 15.6% | 81.4 | 57,708.8 |
| 1997 | 495 | 13.7% | 75.3 | 37,292.4 |
| 1998 | 356 | 22.1% | 122.2 | 43,507.8 |
| 1999 | 633 | 76.9% | 132.2 | 83,708.4 |
| 2000 | 506 | 59.4% | 148.4 | 75,076.2 |
| 2001 | 102 | 14.4% | 443.3 | 45,220.8 |
| 2002 | 78 | 8.8% | 302.2 | 23,575.3 |
| 2003 | 67 | 13.1% | 179.1 | 11,997.0 |
| 2004 | 167 | 12.4% | 214.9 | 35,894.3 |
| 2005 | 156 | 9.3% | 202.0 | 31,518.8 |
| 2006 | 138 | 12.7% | 205.1 | 28,297.0 |
| 2007 | 142 | 13.1% | 197.3 | 28,013.8 |
| 2008 | 20 | 5.0% | 1,249.9 | 24,997.9 |
| 2009 | 40 | 12.5% | 337.2 | 13,489.1 |
| 2010 | 93 | 7.3% | 345.3 | 32,115.8 |
| 2011 | 80 | 13.8% | 324.4 | 25,953.1 |
| 2012 | 96 | 19.5% | 342.7 | 32,895.2 |
| 2013 | 157 | 20.0% | 258.7 | 40,618.1 |
| 2014 | 202 | 16.4% | 208.5 | 42,111.3 |
| 2015 | 117 | 16.5% | 195.2 | 22,832.6 |
| **Total** | **9145** | **19.1%** | **111.2** | **1,017,222.1** |

**Table 2. IPO Initial Returns by the Proceeds Amount, 1972-2015**

This table presents the number of IPOs and average initial returns within three groups: IPOs with proceeds below $30 million, IPOs with proceeds between $30 million and $120 million, and IPOs with proceeds above $120 million. Proceeds are in real 2015 million dollars. Further details on sample composition are provided in Table 1.

| Year | # IPOs | # IPOs, Proceed < 30mln | # IPOs, Proceeds between 30mln and 120mln | # IPOs, Proceeds > 120mln | Initial Returns, Proceeds < 30 mln | Initial Returns, Proceeds between 30 mln and 120 mln | Initial Returns, Proceeds > 120 mln |
|---|---|---|---|---|---|---|---|
| 1972 | 1 | 0 | 1 | 0 | NA | 2.0% | NA |
| 1973 | 13 | 8 | 5 | 0 | 12.5% | 8.1% | NA |
| 1974 | 4 | 3 | 1 | 0 | 7.2% | 1.4% | NA |
| 1975 | 9 | 3 | 5 | 1 | 10.5% | 0.8% | -0.8% |
| 1976 | 26 | 19 | 7 | 0 | 2.8% | 3.5% | NA |
| 1977 | 17 | 15 | 2 | 0 | 4.4% | 3.2% | NA |
| 1978 | 19 | 11 | 8 | 0 | 15.0% | 14.8% | NA |
| 1979 | 42 | 32 | 9 | 1 | 8.3% | 16.9% | 150.0% |
| 1980 | 66 | 42 | 21 | 3 | 12.1% | 22.8% | 19.0% |
| 1981 | 183 | 125 | 55 | 3 | 6.9% | 6.3% | 1.0% |
| 1982 | 68 | 49 | 18 | 1 | 10.7% | 15.7% | 44.6% |
| 1983 | 461 | 256 | 173 | 32 | 10.8% | 9.8% | 7.1% |
| 1984 | 181 | 138 | 40 | 3 | 2.9% | 2.1% | 0.8% |
| 1985 | 219 | 143 | 63 | 13 | 9.9% | 4.9% | 5.3% |
| 1986 | 505 | 296 | 169 | 40 | 7.9% | 7.3% | 5.9% |
| 1987 | 337 | 180 | 132 | 25 | 6.4% | 5.3% | 6.4% |
| 1988 | 138 | 79 | 48 | 11 | 5.6% | 3.7% | 1.4% |
| 1989 | 125 | 58 | 58 | 9 | 8.7% | 7.6% | 2.8% |
| 1990 | 115 | 40 | 63 | 12 | 9.6% | 10.3% | 3.4% |
| 1991 | 324 | 114 | 172 | 38 | 8.2% | 11.8% | 8.7% |
| 1992 | 450 | 159 | 222 | 69 | 7.6% | 10.8% | 6.4% |
| 1993 | 576 | 210 | 292 | 74 | 10.3% | 14.0% | 9.3% |
| 1994 | 418 | 182 | 200 | 36 | 5.8% | 10.5% | 5.9% |
| 1995 | 494 | 128 | 301 | 65 | 17.2% | 22.7% | 14.6% |
| 1996 | 709 | 205 | 407 | 97 | 10.8% | 17.4% | 18.1% |
| 1997 | 495 | 138 | 294 | 63 | 8.5% | 15.8% | 15.1% |
| 1998 | 356 | 115 | 183 | 58 | 18.7% | 27.2% | 12.9% |
| 1999 | 633 | 158 | 336 | 139 | 81.2% | 72.6% | 82.2% |
| 2000 | 506 | 127 | 256 | 123 | 64.7% | 49.6% | 74.4% |
| 2001 | 102 | 25 | 31 | 46 | 16.7% | 15.6% | 12.2% |
| 2002 | 78 | 14 | 30 | 34 | 7.3% | 6.3% | 11.6% |
| 2003 | 67 | 6 | 25 | 36 | 15.9% | 13.1% | 12.7% |
| 2004 | 167 | 11 | 91 | 65 | 3.1% | 10.3% | 16.9% |
| 2005 | 156 | 18 | 64 | 74 | 3.7% | 7.6% | 12.2% |
| 2006 | 138 | 9 | 67 | 62 | -0.1% | 10.5% | 17.0% |
| 2007 | 142 | 6 | 71 | 65 | -13.3% | 10.9% | 18.0% |
| 2008 | 20 | 2 | 6 | 12 | 9.3% | -0.1% | 6.9% |
| 2009 | 40 | 0 | 13 | 27 | NA | 9.7% | 13.8% |
| 2010 | 93 | 5 | 43 | 45 | -15.1% | 6.6% | 10.6% |
| 2011 | 80 | 4 | 29 | 47 | 10.8% | 12.4% | 14.9% |
| 2012 | 96 | 6 | 51 | 39 | 18.6% | 19.2% | 20.1% |
| 2013 | 157 | 15 | 72 | 70 | -2.0% | 21.8% | 22.8% |
| 2014 | 202 | 15 | 115 | 72 | 15.4% | 16.3% | 16.7% |
| 2015 | 117 | 9 | 64 | 44 | 3.5% | 13.2% | 24.0% |
| **Total** | **9145** | **3178** | **4313** | **1654** | **14.8%** | **20.4%** | **23.9%** |

**Table 3. Initial Returns and the Initial Price Range, 1983-2015**

This table presents the number of IPOs and average initial returns for three groups: IPOs with whose offer price is below the initial price range, within the initial price range, and above the initial price range. Further details on the sample composition are provided in Figure 1. The sample in this figure is additionally restricted to companies that went public in 1983 - 2015, as SDC does not have the initial price range information for IPOs in earlier years.

| Year | # IPOs | # IPOs, offer price < range | # IPOs, offer price within initial range | # IPOs, offer price above the range | Initial Returns, offer price below initial range | Initial Returns, offer price within initial range | Initial Returns, offer price above initial range |
|---|---|---|---|---|---|---|---|
| 1983 | 342 | 100 | 193 | 49 | 2.1% | 11.5% | 24.7% |
| 1984 | 129 | 67 | 58 | 4 | 1.2% | 3.2% | 17.2% |
| 1985 | 187 | 43 | 131 | 13 | 2.6% | 8.3% | 13.6% |
| 1986 | 405 | 86 | 296 | 23 | 0.4% | 8.0% | 22.9% |
| 1987 | 277 | 70 | 188 | 19 | 0.0% | 6.6% | 16.7% |
| 1988 | 100 | 28 | 68 | 4 | 1.6% | 7.9% | 7.1% |
| 1989 | 104 | 9 | 81 | 14 | 0.5% | 8.7% | 10.4% |
| 1990 | 103 | 18 | 67 | 18 | 2.6% | 9.2% | 19.7% |
| 1991 | 286 | 42 | 204 | 40 | 2.8% | 10.8% | 18.7% |
| 1992 | 408 | 68 | 287 | 53 | 2.0% | 9.0% | 20.9% |
| 1993 | 518 | 68 | 368 | 82 | 2.7% | 10.8% | 26.3% |
| 1994 | 377 | 97 | 249 | 31 | 2.1% | 8.6% | 22.3% |
| 1995 | 440 | 48 | 281 | 111 | 2.8% | 14.9% | 41.0% |
| 1996 | 702 | 84 | 489 | 129 | 2.9% | 13.0% | 33.0% |
| 1997 | 491 | 80 | 331 | 80 | 3.9% | 13.2% | 25.0% |
| 1998 | 350 | 42 | 250 | 58 | 0.7% | 19.6% | 47.3% |
| 1999 | 604 | 38 | 360 | 206 | 1.2% | 51.9% | 128.6% |
| 2000 | 499 | 53 | 272 | 174 | 6.0% | 27.1% | 127.1% |
| 2001 | 99 | 14 | 71 | 14 | 5.8% | 13.8% | 25.2% |
| 2002 | 75 | 17 | 49 | 9 | 0.7% | 7.7% | 29.1% |
| 2003 | 67 | 8 | 45 | 14 | 11.5% | 9.6% | 25.3% |
| 2004 | 164 | 35 | 102 | 27 | 5.4% | 11.2% | 25.7% |
| 2005 | 149 | 34 | 86 | 29 | 0.1% | 8.7% | 23.1% |
| 2006 | 138 | 39 | 72 | 27 | 2.1% | 8.9% | 38.1% |
| 2007 | 139 | 35 | 72 | 32 | 1.4% | 11.2% | 30.9% |
| 2008 | 19 | 3 | 13 | 3 | -4.2% | 1.1% | 34.2% |
| 2009 | 39 | 14 | 15 | 10 | 2.0% | 12.4% | 28.4% |
| 2010 | 93 | 29 | 54 | 10 | 4.2% | 5.7% | 25.3% |
| 2011 | 80 | 17 | 40 | 23 | -1.3% | 11.3% | 29.4% |
| 2012 | 95 | 25 | 49 | 21 | 5.2% | 17.8% | 39.7% |
| 2013 | 154 | 31 | 85 | 38 | 2.4% | 16.4% | 44.0% |
| 2014 | 196 | 64 | 102 | 30 | 4.0% | 12.8% | 56.2% |
| 2015 | 116 | 31 | 59 | 26 | 3.1% | 12.0% | 44.0% |
| **Total** | **7945** | **1437** | **5087** | **1421** | **2.4%** | **15.0%** | **56.8%** |

**Table 4 Mean Initial Return for IPOs with and without Venture Capitalist Backing, 1972-2015**

For IPOs with versus without VC backing, this table shows: the number of IPOs, average initial returns, firm age, and portion of companies in a technology industry. We rely on SDC for information on VC backing ('Venture Backed' variable), offer price, and membership in a technology industry ('Technology Industry' variable). Firm age is obtained from Jay Ritter website.[32] Further details on the sample composition are provided in Figure 1.

| Year | # IPOs | #IPOs, VC | #IPOs, no VC | Initial Returns, VC | Initial Returns, no VC | Age, VC | Age, no VC | % Tech IPO, VC | % Tech IPO, no VC |
|---|---|---|---|---|---|---|---|---|---|
| 1972 | 1 | 0 | 1 | NA | 2.0% | NA | NA | NA | 0.0% |
| 1973 | 13 | 3 | 10 | 13.8% | 9.9% | NA | NA | 33.3% | 30.0% |
| 1974 | 4 | 1 | 3 | 9.8% | 4.4% | NA | NA | 100.0% | 0.0% |
| 1975 | 9 | 0 | 9 | NA | 3.8% | NA | 43.8 | NA | 22.2% |
| 1976 | 26 | 11 | 15 | 6.8% | 0.2% | 8.7 | 32.3 | 63.6% | 20.0% |
| 1977 | 17 | 3 | 14 | 14.5% | 2.1% | 2.7 | 10.6 | 33.3% | 7.1% |
| 1978 | 19 | 9 | 10 | 22.8% | 7.9% | 9.1 | 24.6 | 88.9% | 20.0% |
| 1979 | 42 | 16 | 26 | 13.9% | 13.3% | 9.7 | 15.0 | 62.5% | 23.1% |
| 1980 | 66 | 26 | 40 | 23.5% | 10.8% | 7.3 | 10.9 | 73.1% | 32.5% |
| 1981 | 183 | 60 | 123 | 8.9% | 5.5% | 10.1 | 13.1 | 63.3% | 29.3% |
| 1982 | 68 | 22 | 46 | 14.3% | 11.6% | 9.0 | 9.9 | 90.9% | 32.6% |
| 1983 | 461 | 112 | 349 | 12.8% | 9.3% | 7.2 | 20.3 | 68.8% | 24.1% |
| 1984 | 181 | 47 | 134 | 2.8% | 2.6% | 8.1 | 24.4 | 70.2% | 16.4% |
| 1985 | 219 | 36 | 183 | 4.9% | 8.9% | 9.3 | 26.1 | 52.8% | 14.2% |
| 1986 | 505 | 94 | 411 | 8.4% | 7.3% | 9.3 | 26.4 | 60.6% | 12.7% |
| 1987 | 337 | 80 | 257 | 8.0% | 5.3% | 7.3 | 29.4 | 73.8% | 10.9% |
| 1988 | 138 | 34 | 104 | 8.9% | 3.2% | 5.8 | 36.1 | 70.6% | 17.3% |
| 1989 | 125 | 37 | 88 | 11.8% | 6.0% | 7.3 | 21.2 | 59.5% | 21.6% |
| 1990 | 115 | 38 | 77 | 12.8% | 7.6% | 9.3 | 26.5 | 76.3% | 11.7% |
| 1991 | 324 | 119 | 205 | 13.6% | 8.1% | 8.9 | 27.5 | 77.3% | 22.9% |
| 1992 | 450 | 154 | 296 | 12.7% | 7.1% | 10.8 | 30.1 | 68.2% | 23.0% |
| 1993 | 576 | 174 | 402 | 14.1% | 11.1% | 9.9 | 20.3 | 68.4% | 16.9% |
| 1994 | 418 | 131 | 287 | 12.2% | 6.2% | 10.3 | 19.4 | 66.4% | 23.0% |
| 1995 | 494 | 196 | 298 | 28.6% | 14.7% | 10.7 | 15.6 | 79.1% | 36.2% |
| 1996 | 709 | 257 | 452 | 17.7% | 14.4% | 10.4 | 18.6 | 75.5% | 38.9% |
| 1997 | 495 | 150 | 345 | 17.7% | 11.9% | 10.4 | 24.6 | 68.0% | 35.9% |
| 1998 | 356 | 100 | 256 | 32.8% | 18.0% | 8.4 | 21.2 | 86.0% | 35.2% |
| 1999 | 633 | 381 | 252 | 99.9% | 42.0% | 5.8 | 19.8 | 89.2% | 62.7% |
| 2000 | 506 | 356 | 150 | 73.7% | 25.5% | 6.0 | 22.3 | 95.5% | 62.0% |
| 2001 | 102 | 44 | 57 | 18.9% | 11.1% | 10.4 | 31.7 | 75.0% | 45.6% |
| 2002 | 78 | 29 | 49 | 11.5% | 7.3% | 22.6 | 28.7 | 69.0% | 34.7% |
| 2003 | 67 | 27 | 40 | 16.3% | 11.0% | 11.5 | 33.1 | 81.5% | 27.5% |
| 2004 | 167 | 75 | 92 | 13.6% | 11.5% | 8.3 | 26.0 | 85.3% | 25.0% |
| 2005 | 156 | 44 | 112 | 11.9% | 8.3% | 9.5 | 37.0 | 90.9% | 25.9% |
| 2006 | 138 | 58 | 80 | 16.6% | 9.9% | 9.3 | 36.2 | 81.0% | 23.8% |
| 2007 | 142 | 70 | 72 | 21.6% | 4.9% | 8.6 | 26.8 | 85.7% | 25.0% |
| 2008 | 20 | 7 | 13 | 3.8% | 5.7% | 11.3 | 40.7 | 85.7% | 7.7% |
| 2009 | 40 | 10 | 30 | 21.8% | 9.4% | 9.1 | 36.5 | 70.0% | 50.0% |
| 2010 | 93 | 33 | 60 | 11.6% | 5.0% | 10.0 | 27.2 | 63.6% | 20.0% |
| 2011 | 80 | 36 | 44 | 21.0% | 7.9% | 8.7 | 22.3 | 83.3% | 25.0% |
| 2012 | 96 | 44 | 52 | 22.5% | 17.0% | 9.7 | 31.8 | 86.4% | 17.3% |
| 2013 | 157 | 67 | 90 | 26.2% | 15.4% | 10.3 | 34.7 | 85.1% | 22.2% |
| 2014 | 202 | 99 | 103 | 23.0% | 10.0% | 9.9 | 24.5 | 89.9% | 25.2% |
| 2015 | 117 | 58 | 59 | 24.9% | 8.3% | 8.4 | 14.8 | 89.7% | 32.2% |
| **Total** | **9145** | **3348** | **5796** | **32.2%** | **11.5%** | **8.8** | **23.7** | **78.6%** | **27.5%** |

[32] We thank Jay Ritter for making this information publicly available on his website.

**Table 5. IPO Initial Returns and Underwriter Spread, 1980-2015**

The left-hand side of the table shows the portion of IPOs per year with the underwriter spread below, equal to and above 7%. The right-hand side of the table shows average spreads among IPOs with proceeds less than $30 million, between 30 and $120 million, and greater than $120 million. Information regarding proceeds (which are expressed in real 2015 dollars) and the underwriter spread are obtained from SDC. The composition of the IPO sample is described in Figure 1, and the sample in further restricted to offerings in 1980-2015 with non-missing information on the underwriter spread.

| | | Percent of IPOs with spread: | | | Average spread among IPOs with proceeds: | | |
|---|---|---|---|---|---|---|---|
| Year | # IPOs | < 7% | = 7% | > 7% | < 30 mln | 30 -120 mln | > 120 mln |
| 1980 | 66 | 10.6% | 3.0% | 86.4% | 8.3% | 7.2% | 6.0% |
| 1981 | 183 | 12.6% | 4.4% | 83.1% | 8.2% | 7.2% | 6.3% |
| 1982 | 68 | 8.8% | 10.3% | 80.9% | 8.2% | 7.1% | 7.0% |
| 1983 | 461 | 29.3% | 14.1% | 56.5% | 8.1% | 6.9% | 6.2% |
| 1984 | 181 | 11.0% | 15.5% | 73.5% | 7.9% | 7.0% | 6.6% |
| 1985 | 219 | 24.2% | 12.3% | 63.5% | 8.0% | 6.9% | 6.2% |
| 1986 | 505 | 34.5% | 14.7% | 50.9% | 7.8% | 6.9% | 5.9% |
| 1987 | 337 | 35.3% | 21.1% | 43.6% | 7.6% | 6.8% | 5.6% |
| 1988 | 138 | 34.8% | 29.0% | 36.2% | 7.4% | 6.7% | 5.7% |
| 1989 | 125 | 31.4% | 38.0% | 30.6% | 7.6% | 6.8% | 5.8% |
| 1990 | 115 | 29.8% | 44.7% | 25.4% | 7.5% | 6.9% | 5.5% |
| 1991 | 324 | 31.8% | 45.5% | 22.7% | 7.4% | 6.7% | 5.9% |
| 1992 | 450 | 29.6% | 48.9% | 21.6% | 7.7% | 6.8% | 5.9% |
| 1993 | 576 | 25.6% | 53.5% | 20.9% | 7.8% | 6.9% | 6.0% |
| 1994 | 418 | 21.1% | 53.7% | 25.2% | 7.6% | 6.9% | 5.8% |
| 1995 | 494 | 22.2% | 62.5% | 15.3% | 7.9% | 6.9% | 6.0% |
| 1996 | 709 | 21.0% | 65.6% | 13.5% | 7.6% | 6.9% | 6.2% |
| 1997 | 495 | 18.9% | 68.8% | 12.4% | 7.6% | 6.9% | 6.4% |
| 1998 | 356 | 21.1% | 69.1% | 9.7% | 7.5% | 6.9% | 6.0% |
| 1999 | 633 | 15.3% | 79.8% | 4.8% | 7.2% | 6.9% | 6.4% |
| 2000 | 506 | 13.1% | 84.7% | 2.2% | 7.2% | 7.0% | 6.5% |
| 2001 | 102 | 33.0% | 64.0% | 3.0% | 7.1% | 6.9% | 5.9% |
| 2002 | 78 | 19.5% | 76.6% | 3.9% | 6.8% | 6.9% | 6.6% |
| 2003 | 67 | 22.4% | 76.1% | 1.5% | 7.0% | 7.0% | 6.7% |
| 2004 | 167 | 20.4% | 79.0% | 0.6% | 7.0% | 7.0% | 6.4% |
| 2005 | 156 | 34.0% | 63.4% | 2.6% | 6.9% | 6.9% | 6.3% |
| 2006 | 138 | 24.8% | 70.1% | 5.1% | 7.2% | 7.0% | 6.5% |
| 2007 | 142 | 24.6% | 72.5% | 2.9% | 6.8% | 7.0% | 6.5% |
| 2008 | 20 | 36.8% | 63.2% | 0.0% | 7.0% | 7.0% | 6.0% |
| 2009 | 40 | 50.0% | 50.0% | 0.0% | NA | 6.9% | 6.1% |
| 2010 | 93 | 34.5% | 62.1% | 3.4% | 7.1% | 7.1% | 6.4% |
| 2011 | 80 | 37.3% | 58.7% | 4.0% | 6.5% | 7.0% | 6.1% |
| 2012 | 96 | 29.2% | 68.5% | 2.2% | 7.0% | 7.0% | 6.1% |
| 2013 | 157 | 35.7% | 61.7% | 2.6% | 7.0% | 6.9% | 6.1% |
| 2014 | 202 | 27.8% | 70.6% | 1.5% | 7.1% | 6.9% | 6.0% |
| 2015 | 117 | 31.0% | 65.5% | 3.4% | 7.1% | 6.9% | 6.3% |
| **Total** | **9014** | **24.5%** | **52.4%** | **23.1%** | **7.7%** | **6.9%** | **6.2%** |

**Table 6. Number of Lead Underwriters and Co-managers, 1972-2015**

This table presents the average number of lead underwriters and co-managers for IPOs between 1972 and 2015. Last six columns of the table present the average lead managers and co-managers for the IPOs with proceeds below $30 million, between $30 million and $120 million, and above $120 million. Information about the managers and syndicate member is obtained from SDC, where codes "BM", "JB", "JL" (book manager, joint book, and joint lead, respectively) are defined as lead managers, "CM" as co-managers, and "SD" as other syndicate members. The composition of the IPO sample is described in Figure 1.

| | | | | IPOs with prceeds < $30 mln | | IPOs with proceeds between $30 - 120 mln | | IPOs with proceeds > $120 mln | |
|---|---|---|---|---|---|---|---|---|---|
| Year | # IPOs | # Leads | # Co-mgrs | # Leads | # Co-mgrs | # Leads | # Co-mgrs | # Leads | # Co-mgrs |
| 1972 | 1 | 1.00 | 1.00 | NA | NA | 1.00 | 1.00 | NA | NA |
| 1973 | 13 | 1.00 | 0.46 | 1.00 | 0.38 | 1.00 | 0.60 | NA | NA |
| 1974 | 4 | 1.00 | 0.25 | 1.00 | 0.00 | 1.00 | 1.00 | NA | NA |
| 1975 | 9 | 1.00 | 0.44 | 1.00 | 0.33 | 1.00 | 0.60 | 1.00 | 0.00 |
| 1976 | 26 | 1.00 | 0.50 | 1.00 | 0.26 | 1.00 | 1.14 | NA | NA |
| 1977 | 17 | 1.06 | 0.53 | 1.00 | 0.60 | 1.50 | 0.00 | NA | NA |
| 1978 | 19 | 1.11 | 0.63 | 1.18 | 0.55 | 1.00 | 0.75 | NA | NA |
| 1979 | 42 | 1.02 | 0.24 | 1.03 | 0.16 | 1.00 | 0.44 | 1.00 | 1.00 |
| 1980 | 66 | 1.00 | 0.38 | 1.00 | 0.14 | 1.00 | 0.76 | 1.00 | 1.00 |
| 1981 | 183 | 1.04 | 0.38 | 1.03 | 0.23 | 1.04 | 0.73 | 1.67 | 0.33 |
| 1982 | 68 | 1.00 | 0.44 | 1.00 | 0.27 | 1.00 | 0.89 | 1.00 | 1.00 |
| 1983 | 461 | 1.04 | 0.49 | 1.01 | 0.24 | 1.07 | 0.71 | 1.09 | 1.25 |
| 1984 | 181 | 1.03 | 0.59 | 1.03 | 0.45 | 1.05 | 1.03 | 1.00 | 1.33 |
| 1985 | 219 | 1.03 | 0.42 | 1.03 | 0.21 | 1.03 | 0.68 | 1.00 | 1.54 |
| 1986 | 505 | 1.03 | 0.99 | 1.03 | 0.52 | 1.03 | 0.98 | 1.00 | 4.50 |
| 1987 | 337 | 1.02 | 1.73 | 1.02 | 0.82 | 1.02 | 1.98 | 1.00 | 6.96 |
| 1988 | 138 | 1.02 | 1.91 | 1.04 | 1.25 | 1.00 | 2.90 | 1.00 | 2.27 |
| 1989 | 125 | 1.00 | 1.88 | 1.00 | 1.59 | 1.00 | 1.74 | 1.00 | 4.67 |
| 1990 | 115 | 1.01 | 1.73 | 1.03 | 1.58 | 1.00 | 1.70 | 1.00 | 2.42 |
| 1991 | 324 | 1.05 | 2.10 | 1.03 | 1.35 | 1.04 | 2.24 | 1.16 | 3.66 |
| 1992 | 450 | 1.02 | 1.87 | 1.02 | 0.89 | 1.03 | 2.04 | 1.03 | 3.58 |
| 1993 | 576 | 1.02 | 1.59 | 1.00 | 0.83 | 1.02 | 1.97 | 1.04 | 2.28 |
| 1994 | 418 | 1.01 | 1.34 | 1.01 | 0.82 | 1.01 | 1.40 | 1.03 | 3.61 |
| 1995 | 494 | 1.04 | 2.19 | 1.00 | 1.70 | 1.02 | 1.90 | 1.20 | 4.54 |
| 1996 | 709 | 1.02 | 1.71 | 1.00 | 0.80 | 1.01 | 1.78 | 1.09 | 3.36 |
| 1997 | 495 | 1.04 | 1.83 | 1.01 | 1.54 | 1.04 | 1.79 | 1.11 | 2.62 |
| 1998 | 356 | 1.07 | 2.17 | 1.03 | 1.17 | 1.04 | 2.04 | 1.24 | 4.57 |
| 1999 | 633 | 1.17 | 2.48 | 1.18 | 1.95 | 1.10 | 2.35 | 1.32 | 3.41 |
| 2000 | 506 | 1.24 | 2.50 | 1.15 | 1.92 | 1.20 | 2.19 | 1.43 | 3.72 |
| 2001 | 102 | 1.50 | 3.13 | 1.32 | 1.72 | 1.42 | 2.06 | 1.65 | 4.61 |
| 2002 | 78 | 1.51 | 4.46 | 1.29 | 7.86 | 1.37 | 3.00 | 1.74 | 4.35 |
| 2003 | 67 | 1.54 | 2.85 | 1.50 | 4.33 | 1.28 | 2.16 | 1.72 | 3.08 |
| 2004 | 167 | 1.72 | 2.75 | 1.18 | 0.82 | 1.55 | 1.86 | 2.05 | 4.32 |
| 2005 | 156 | 1.81 | 2.63 | 1.06 | 0.44 | 1.44 | 2.08 | 2.32 | 3.64 |
| 2006 | 138 | 1.88 | 2.75 | 1.22 | 0.89 | 1.54 | 2.16 | 2.35 | 3.65 |
| 2007 | 142 | 1.92 | 3.06 | 1.00 | 1.67 | 1.56 | 2.54 | 2.40 | 3.75 |
| 2008 | 20 | 2.40 | 5.00 | 1.00 | 0.50 | 1.50 | 2.00 | 3.08 | 7.25 |
| 2009 | 40 | 2.93 | 3.78 | NA | NA | 2.00 | 2.08 | 3.37 | 4.59 |
| 2010 | 93 | 2.57 | 3.29 | 1.40 | 0.20 | 1.95 | 2.67 | 3.29 | 4.22 |
| 2011 | 80 | 2.88 | 3.84 | 1.25 | 0.75 | 2.14 | 2.17 | 3.47 | 5.13 |
| 2012 | 96 | 3.01 | 3.25 | 1.67 | 0.67 | 2.37 | 2.37 | 4.05 | 4.79 |
| 2013 | 157 | 3.41 | 3.38 | 1.13 | 1.27 | 2.51 | 1.90 | 4.83 | 5.36 |
| 2014 | 202 | 3.22 | 3.02 | 1.20 | 0.33 | 2.46 | 2.04 | 4.85 | 5.15 |
| 2015 | 117 | 3.27 | 2.26 | 1.33 | 0.78 | 2.52 | 1.78 | 4.77 | 3.25 |
| **Total** | **9145** | **1.30** | **1.89** | **1.04** | **0.93** | **1.20** | **1.85** | **2.04** | **3.87** |

**Table 7. IPO Registration Length, 1983-2015**

This table shows the length of the registration period and the number of IPOs by year. The last three columns present the average length of the registration period for the IPOs with proceeds below $30 million, between $30 million and $120 million, and above $120 million. The length of the registration period is defined as the number of days between the filing of the first IPO prospectus and the IPO date, where both variables are taken from SDC. The composition of the sample is described in Table 1, and the sample is further restricted to the companies that went public between 1983 and 2015 as SDC does not include information on the filing date prior to 1983.

| Year | # IPOs | Registration Period Length (days) | Registration Period Length (days) among IPOs with: Proceeds < 30 mln | Proceeds 30 – 120 mln | Proceeds > 120 mln |
|---|---|---|---|---|---|
| 1983 | 343 | 48.7 | 50.6 | 47.0 | 41.6 |
| 1984 | 130 | 48.7 | 49.4 | 48.4 | 17.5 |
| 1985 | 187 | 38.5 | 40.0 | 36.4 | 30.9 |
| 1986 | 423 | 33.6 | 36.1 | 30.8 | 26.8 |
| 1987 | 297 | 45.8 | 48.0 | 44.8 | 36.8 |
| 1988 | 119 | 45.4 | 48.2 | 40.3 | 52.7 |
| 1989 | 122 | 50.0 | 56.7 | 44.4 | 43.9 |
| 1990 | 114 | 56.7 | 68.4 | 48.3 | 62.3 |
| 1991 | 322 | 61.3 | 65.4 | 58.6 | 61.0 |
| 1992 | 448 | 67.8 | 72.8 | 63.4 | 70.7 |
| 1993 | 572 | 69.9 | 69.7 | 68.7 | 75.1 |
| 1994 | 417 | 67.7 | 69.8 | 64.5 | 75.1 |
| 1995 | 494 | 67.6 | 65.8 | 68.4 | 67.6 |
| 1996 | 708 | 96.4 | 80.6 | 78.9 | 203.1 |
| 1997 | 495 | 97.8 | 103.2 | 97.8 | 86.0 |
| 1998 | 356 | 97.9 | 95.8 | 103.9 | 83.4 |
| 1999 | 632 | 93.8 | 83.9 | 99.6 | 91.0 |
| 2000 | 505 | 103.9 | 108.9 | 104.1 | 98.3 |
| 2001 | 102 | 160.6 | 191.9 | 189.0 | 124.4 |
| 2002 | 78 | 142.0 | 169.9 | 133.7 | 137.9 |
| 2003 | 67 | 131.9 | 74.3 | 112.3 | 155.1 |
| 2004 | 165 | 113.7 | 136.7 | 113.0 | 110.8 |
| 2005 | 155 | 132.2 | 79.6 | 140.0 | 138.4 |
| 2006 | 138 | 134.6 | 157.8 | 138.3 | 127.2 |
| 2007 | 141 | 131.7 | 177.2 | 134.4 | 124.4 |
| 2008 | 19 | 191.5 | 318.5 | 151.4 | 187.0 |
| 2009 | 40 | 269.0 | NA | 281.8 | 262.7 |
| 2010 | 93 | 162.2 | 99.0 | 156.6 | 174.5 |
| 2011 | 80 | 182.7 | 344.3 | 211.6 | 151.1 |
| 2012 | 96 | 192.3 | 105.0 | 219.6 | 169.9 |
| 2013 | 157 | 100.7 | 108.0 | 76.4 | 124.0 |
| 2014 | 202 | 76.9 | 95.4 | 53.3 | 110.8 |
| 2015 | 117 | 78.0 | 172.4 | 51.2 | 97.7 |
| **Total** | **8334** | **84.8** | **71.3** | **82.9** | **111.6** |

**Table 8. Dynamics of the Average Offer IPO Price**

This table shows the average nominal offer price by year. Last three columns of the table present the average nominal offer price for the IPOs with proceeds below $30 million, between $30 million and $120 million, and above $120 million. Proceeds are adjusted for the dollar purchasing power in 2015 using GDP implicit price deflator. Collection of the sample is described in the legend of the Table 1.

| | | | Offer Price among IPOs with: | | |
|---|---|---|---|---|---|
| Year | # IPO | Offer Price | Proceeds < 30 mln | Proceeds 30 – 120 mln | Proceeds > 120 mln |
| 1980 | 66 | 14.0 | 11.3 | 18.2 | 23.0 |
| 1981 | 183 | 12.2 | 10.2 | 16.1 | 20.6 |
| 1982 | 68 | 11.7 | 10.1 | 15.7 | 21.0 |
| 1983 | 461 | 12.5 | 10.1 | 14.9 | 18.9 |
| 1984 | 181 | 9.6 | 8.8 | 11.5 | 15.6 |
| 1985 | 219 | 11.0 | 9.5 | 13.2 | 16.1 |
| 1986 | 505 | 11.7 | 9.8 | 13.4 | 18.2 |
| 1987 | 337 | 11.7 | 9.2 | 13.3 | 21.3 |
| 1988 | 138 | 11.5 | 9.2 | 13.3 | 19.8 |
| 1989 | 125 | 12.6 | 9.9 | 14.0 | 21.0 |
| 1990 | 115 | 12.1 | 9.0 | 12.6 | 19.2 |
| 1991 | 324 | 12.6 | 9.7 | 13.3 | 18.1 |
| 1992 | 450 | 12.5 | 8.7 | 13.8 | 17.5 |
| 1993 | 576 | 12.9 | 9.5 | 13.8 | 19.0 |
| 1994 | 418 | 11.8 | 9.0 | 13.2 | 18.0 |
| 1995 | 494 | 13.3 | 8.7 | 14.0 | 18.9 |
| 1996 | 709 | 14.8 | 8.8 | 14.0 | 30.6 |
| 1997 | 495 | 12.9 | 9.2 | 13.3 | 19.2 |
| 1998 | 356 | 13.4 | 10.8 | 13.5 | 18.2 |
| 1999 | 633 | 15.4 | 13.6 | 14.1 | 20.8 |
| 2000 | 506 | 15.2 | 14.0 | 14.1 | 18.8 |
| 2001 | 102 | 16.2 | 13.9 | 12.3 | 20.0 |
| 2002 | 78 | 15.1 | 12.8 | 13.0 | 18.0 |
| 2003 | 67 | 15.4 | 15.2 | 13.1 | 17.0 |
| 2004 | 167 | 13.8 | 9.7 | 11.3 | 17.9 |
| 2005 | 156 | 14.9 | 10.3 | 13.1 | 17.5 |
| 2006 | 138 | 14.5 | 8.4 | 11.6 | 18.5 |
| 2007 | 142 | 14.6 | 9.0 | 12.5 | 17.4 |
| 2008 | 20 | 15.6 | 8.4 | 12.2 | 18.6 |
| 2009 | 40 | 14.7 | NA | 13.1 | 15.4 |
| 2010 | 93 | 13.5 | 9.6 | 10.8 | 16.4 |
| 2011 | 80 | 15.3 | 9.5 | 11.5 | 18.1 |
| 2012 | 96 | 15.1 | 8.4 | 13.1 | 18.6 |
| 2013 | 157 | 15.8 | 8.5 | 13.5 | 19.8 |
| 2014 | 202 | 15.0 | 7.5 | 13.5 | 18.9 |
| 2015 | 117 | 15.4 | 10.4 | 13.9 | 18.7 |
| **Total** | **9014** | **13.4** | **9.9** | **13.6** | **19.3** |

**Table 9. IPO Delisting for Poor Performance and Acquisition, 1972-2015**

The table shows the percent of IPOs delisted for the poor performance within 3, 5 and 10 years after the offering, and the percent of IPO that were acquired within 3, 5 and 10 years after the offering. Delisting and acquisition information are obtained from CRSP. The composition of the sample is described in Table 1.

| | | Percent of IPOs delisted within | | | Percent of IPOs acquired within | | |
|---|---|---|---|---|---|---|---|
| Year | # IPO | 3 years | 5 years | 10 years | 3 years | 5 years | 10 years |
| 1972 | 1 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 1973 | 13 | 0.0% | 0.0% | 0.0% | 7.7% | 15.4% | 38.5% |
| 1974 | 4 | 0.0% | 0.0% | 0.0% | 25.0% | 25.0% | 50.0% |
| 1975 | 9 | 0.0% | 0.0% | 0.0% | 11.1% | 11.1% | 33.3% |
| 1976 | 26 | 0.0% | 3.8% | 15.4% | 15.4% | 30.8% | 50.0% |
| 1977 | 17 | 0.0% | 0.0% | 11.8% | 23.5% | 29.4% | 58.8% |
| 1978 | 19 | 5.3% | 5.3% | 5.3% | 15.8% | 21.1% | 31.6% |
| 1979 | 42 | 0.0% | 2.4% | 14.3% | 4.8% | 21.4% | 42.9% |
| 1980 | 66 | 3.0% | 4.5% | 21.2% | 4.5% | 7.6% | 25.8% |
| 1981 | 183 | 3.8% | 10.4% | 25.1% | 5.5% | 15.3% | 33.9% |
| 1982 | 68 | 5.9% | 7.4% | 16.2% | 11.8% | 19.1% | 35.3% |
| 1983 | 461 | 4.6% | 9.8% | 25.2% | 7.6% | 19.5% | 32.8% |
| 1984 | 181 | 3.9% | 12.7% | 26.5% | 12.7% | 22.1% | 32.6% |
| 1985 | 219 | 6.4% | 11.9% | 21.5% | 12.8% | 21.0% | 33.3% |
| 1986 | 505 | 5.5% | 13.1% | 22.6% | 9.9% | 15.8% | 30.5% |
| 1987 | 337 | 3.9% | 11.6% | 17.2% | 14.5% | 18.7% | 35.0% |
| 1988 | 138 | 5.1% | 10.1% | 15.2% | 5.8% | 15.2% | 37.7% |
| 1989 | 125 | 3.2% | 5.6% | 14.4% | 8.8% | 19.2% | 38.4% |
| 1990 | 115 | 1.7% | 3.5% | 13.0% | 4.3% | 13.9% | 41.7% |
| 1991 | 324 | 1.9% | 4.9% | 16.4% | 3.1% | 15.4% | 37.0% |
| 1992 | 450 | 2.4% | 8.2% | 20.7% | 10.4% | 20.7% | 42.4% |
| 1993 | 576 | 4.7% | 8.2% | 22.4% | 9.0% | 23.8% | 42.4% |
| 1994 | 418 | 4.5% | 9.1% | 21.1% | 12.4% | 27.0% | 45.9% |
| 1995 | 494 | 4.9% | 9.7% | 20.2% | 18.8% | 33.4% | 45.7% |
| 1996 | 709 | 8.5% | 17.2% | 25.5% | 19.3% | 35.1% | 46.1% |
| 1997 | 495 | 8.7% | 19.4% | 26.9% | 19.6% | 32.3% | 42.6% |
| 1998 | 356 | 9.0% | 21.6% | 27.8% | 16.0% | 23.3% | 40.2% |
| 1999 | 633 | 14.4% | 20.4% | 26.2% | 22.1% | 29.2% | 42.3% |
| 2000 | 506 | 11.9% | 16.4% | 23.1% | 16.6% | 27.7% | 46.6% |
| 2001 | 102 | 5.9% | 7.8% | 8.8% | 9.8% | 19.6% | 36.3% |
| 2002 | 78 | 3.8% | 5.1% | 14.1% | 15.4% | 32.1% | 41.0% |
| 2003 | 67 | 3.0% | 10.4% | 17.9% | 13.4% | 31.3% | 38.8% |
| 2004 | 167 | 1.2% | 4.8% | 10.8% | 15.6% | 29.9% | 49.7% |
| 2005 | 156 | 2.6% | 12.8% | 15.4% | 14.1% | 17.9% | 37.8% |
| 2006 | 138 | 5.8% | 8.7% | | 13.8% | 26.8% | |
| 2007 | 142 | 5.6% | 8.5% | | 10.6% | 22.5% | |
| 2008 | 20 | 10.0% | 10.0% | | 10.0% | 10.0% | |
| 2009 | 40 | 0.0% | 5.0% | | 15.0% | 25.0% | |
| 2010 | 93 | 4.3% | 9.7% | | 7.5% | 16.1% | |
| 2011 | 80 | 2.5% | | | 10.0% | | |
| 2012 | 96 | 1.0% | | | 14.6% | | |
| **Total** | **9145** | **6.1%** | **12.1%** | **21.8%** | **13.4%** | **24.4%** | **40.4%** |

**Table 10,** ***3-year and 5-year post-IPO buy and hold returns (similar to Loughran and Ritter 1995, Table 4)***

The sample consists of 7,771 IPOs between 1973 and 2012 in Panel A, and 7,551 IPOs between 1973 and 2010 in Panel B (to allow for the calculation of three-year and five-year post-IPO returns, respective). Buy-and-hold returns for each company are measured from the first CRSP price for three or five years (or until the delisting day if company was delisted within this period). Buy-and-hold returns are compounded daily, and reported in column 3. Each stock's performance is matched with four benchmarks: value-weighted index, equally-weighted index, size Fama-French portfolio (out of 5 size portfolios) and size and book-to-market Fama-French portfolio (out of 25 size and book-to-market portfolios). The indices are both from CRSP and the size and BM portfolios are matched on June 1st of every year. Buy-and-hold returns for each benchmark are measured over the same period as the stock's return. For instance, if company was delisted within three years, the buy-and-hold return for its benchmark would stop on the day of delisting. The wealth relative for each stock is measured as the ratio (1+stock buy and hold return) / (1+ benchmark buy and hold return).

*Panel A: three-year post-IPO returns*

| | IPO Companies | | VW Index | | EW Index | | Size-matched | | Size and BM matched | |
|---|---|---|---|---|---|---|---|---|---|---|
| | #IPOs | Return | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative |
| 1973 – 2012 | 8,668 | 25.6% | 39.4% | 0.88 | 87.9% | 0.69 | 32.7% | 0.93 | 30.8% | 0.95 |
| 1973 – 1979 | 130 | 116.5% | 35.7% | 1.55 | 96.9% | 1.08 | 56.3% | 1.39 | 50.1% | 1.46 |
| 1980 - 1989 | 2,283 | 28.3% | 45.2% | 0.88 | 49.0% | 0.86 | 43.2% | 0.89 | 35.7% | 0.98 |
| 1990 – 1999 | 4,570 | 31.0% | 48.9% | 0.87 | 123.3% | 0.59 | 33.7% | 0.96 | 34.3% | 0.96 |
| 2000 - 2012 | 1,685 | 0.4% | 6.1% | 0.88 | 44.1% | 0.69 | 14.1% | 0.84 | 13.3% | 0.85 |

*Panel B: five-year post-IPO returns*

| | IPO Companies | | VW Index | | EW Index | | Size-matched | | Size and BM matched | |
|---|---|---|---|---|---|---|---|---|---|---|
| | #IPOs | Return | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative | Benchmark Return | Wealth Relative |
| 1973 – 2010 | 8,492 | 41.0% | 64.8% | 0.84 | 174.7% | 0.56 | 57.5% | 0.88 | 56.0% | 0.90 |
| 1973 – 1979 | 130 | 190.0% | 77.2% | 1.65 | 204.5% | 0.96 | 116.2% | 1.40 | 109.0% | 1.49 |
| 1980 - 1989 | 2,283 | 38.8% | 74.1% | 0.80 | 113.8% | 0.68 | 69.7% | 0.81 | 60.2% | 0.91 |
| 1990 – 1999 | 4,570 | 49.7% | 77.2% | 0.83 | 234.0% | 0.47 | 59.7% | 0.91 | 62.2% | 0.91 |
| 2000 - 2010 | 1,509 | 5.0% | 11.9% | 0.88 | 84.3% | 0.59 | 27.4% | 0.82 | 26.2% | 0.82 |

**Table 11: Calendar time portfolio post-IPO returns**

The sample consists of 7,771 IPOs between 1973 and 2012 in Panels A and B, and 7,551 IPOs between 1973 and 2010 in Panels C and D (to allow for the calculation of three- and five-year post-IPO returns, respectively). Each month we form a portfolio of companies that have gone public within the past 36 (Panels A and B) or 60 months (Panels C and D). We regress monthly returns net of the risk-free rate on this portfolio on the three Fama-French factors (RMRF, SMB, and HML) and the Carhart momentum factor (UMD). The intercept, commonly referred to as the alpha, represents a measure of abnormal performance. In Panels A and C portfolio returns are equally weighted, and in Panels B and D they are value-weighted by the market capitalization of each stock, measured at the beginning of the month.

*Panel A: three-year calendar time equally-weighted portfolio regression*

| | Full Sample Period | Sub-periods | | | |
|---|---|---|---|---|---|
| | 1973 – 2012 | 1973 - 1979 | 1980 - 1989 | 1990 - 1999 | 2000 - 2012 |
| Intercept | 0.001 | 0.002 | -0.001 | -0.0001 | 0.001 |
| | (0.001) | (0.006) | (0.002) | (0.002) | (0.003) |
| RMRF | 1.126*** | 0.914*** | 1.046*** | 1.118*** | 1.204*** |
| | (0.034) | (0.127) | (0.047) | (0.047) | (0.065) |
| SMB | 1.138*** | 1.630*** | 1.110*** | 1.133*** | 1.002*** |
| | (0.048) | (0.194) | (0.083) | (0.061) | (0.083) |
| HML | -0.472*** | -0.892*** | -0.373*** | -0.255*** | -0.532*** |
| | (0.053) | (0.210) | (0.085) | (0.077) | (0.082) |
| UMD | -0.335*** | -0.358** | 0.009 | -0.100* | -0.425*** |
| | (0.033) | (0.153) | (0.056) | (0.055) | (0.049) |
| Observations | 515 | 83 | 120 | 120 | 156 |
| Adjusted $R^2$ | 0.853 | 0.801 | 0.917 | 0.924 | 0.880 |

*Panel B: three-year calendar time value-weighted portfolio regression*

| | Full Sample Period | Sub-periods | | | |
|---|---|---|---|---|---|
| | 1973 – 2012 | 1973 - 1979 | 1980 - 1989 | 1990 - 1999 | 2000 - 2012 |
| Intercept | 0.001 | 0.007 | 0.001 | -0.001 | -0.002 |
| | (0.002) | (0.009) | (0.002) | (0.002) | (0.002) |
| RMRF | 1.157*** | 0.652*** | 1.131*** | 1.246*** | 1.355*** |
| | (0.040) | (0.187) | (0.053) | (0.057) | (0.053) |
| SMB | 0.775*** | 1.507*** | 0.896*** | 0.684*** | 0.637*** |
| | (0.057) | (0.286) | (0.093) | (0.074) | (0.068) |
| HML | -0.740*** | -1.596*** | -0.659*** | -0.464*** | -0.722*** |
| | (0.062) | (0.310) | (0.094) | (0.094) | (0.067) |
| UMD | 0.025 | 0.051 | 0.011 | 0.264*** | 0.072* |
| | (0.039) | (0.225) | (0.062) | (0.067) | (0.040) |
| Observations | 515 | 83 | 120 | 120 | 156 |
| Adjusted $R^2$ | 0.788 | 0.584 | 0.915 | 0.895 | 0.899 |

*Panel C: five-year calendar time equally-weighted portfolio regression*

| | Full Sample Period | Sub-periods | | | |
|---|---|---|---|---|---|
| | 1973 – 2012 | 1973 - 1979 | 1980 - 1989 | 1990 - 1999 | 2000 - 2012 |
| Intercept | 0.001 | 0.002 | -0.002 | 0.001 | 0.003 |
| | (0.001) | (0.006) | (0.002) | (0.002) | (0.002) |
| RMRF | 1.115*** | 0.917*** | 1.032*** | 1.074*** | 1.180*** |
| | (0.032) | (0.127) | (0.045) | (0.045) | (0.057) |
| SMB | 1.151*** | 1.621*** | 1.094*** | 1.178*** | 1.047*** |
| | (0.045) | (0.194) | (0.079) | (0.058) | (0.072) |
| HML | -0.347*** | -0.844*** | -0.399*** | -0.129* | -0.310*** |
| | (0.049) | (0.210) | (0.080) | (0.074) | (0.072) |
| UMD | -0.337*** | -0.376** | -0.024 | -0.127** | -0.405*** |
| | (0.031) | (0.152) | (0.053) | (0.053) | (0.043) |
| Observations | 515 | 83 | 120 | 120 | 156 |
| Adjusted $R^2$ | 0.863 | 0.801 | 0.924 | 0.925 | 0.900 |

*Panel D: five-year calendar time value-weighted portfolio regression*

| | Full Sample Period | Sub-periods | | | |
|---|---|---|---|---|---|
| | 1973 – 2012 | 1973 - 1979 | 1980 - 1989 | 1990 - 1999 | 2000 - 2012 |
| Intercept | 0.001 | 0.007 | 0.002 | -0.0005 | -0.002 |
| | (0.002) | (0.009) | (0.002) | (0.002) | (0.002) |
| RMRF | 1.158*** | 0.653*** | 1.097*** | 1.209*** | 1.365*** |
| | (0.038) | (0.184) | (0.054) | (0.040) | (0.046) |
| SMB | 0.707*** | 1.446*** | 0.836*** | 0.699*** | 0.522*** |
| | (0.053) | (0.281) | (0.094) | (0.052) | (0.059) |
| HML | -0.685*** | -1.502*** | -0.799*** | -0.400*** | -0.623*** |
| | (0.059) | (0.304) | (0.096) | (0.066) | (0.058) |
| UMD | -0.051 | -0.008 | -0.044 | 0.154*** | 0.0004 |
| | (0.037) | (0.221) | (0.064) | (0.047) | (0.035) |
| Observations | 515 | 83 | 120 | 120 | 156 |
| Adjusted $R^2$ | 0.798 | 0.580 | 0.912 | 0.941 | 0.917 |